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## (54) METHOD AND PLANT FOR THE AUTOMATIC FABRICATION OF FOOTWEAR

(57) The process applies to the fabrication of any type of footwear, requiring only three operators. The plant includes two conveyor belts (23, 24), in continuous closed cycles, one carrying the lasts (68) and the other one carrying the soles, the belts crossing each other at different points, the first belt over the second belt. In certain sectors of both belts (23, 24), loops are provided to adjust the size to drying or waiting times so that a same robot can carry out various operations. At the points where are carried out works on the shoe, the shoe support corresponding to the conveyor belts (23, 24) is stopped. In the process, a robot (27) places the inner soles on the last (68), the latter carrying, inside, a plurality of data, concerning the model and number, for the right foot and left foot, the sole and other data; another operator mounts the toes, the heels and the shanks, and rotates by 90° the shoe support (23) for its introduction into the heat oven (31). Other robots are used respectively to emboss the shoe, card the upper, apply adhesive both to the sole and the shoe, and a last operator joins the sole to the shoe.

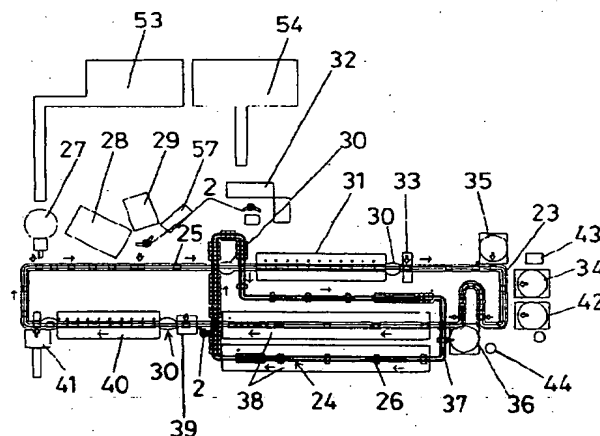


FIG. 3

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## Description

### FIELD OF THE INVENTION

The present invention, as described in the heading of this descriptive report, refers to an automated footwear manufacturing process, and the relative plant, and represents a revolutionary innovation in the technology of automated assembly of footwear, incorporating the most modern technological advances in the science of robotics, air-operated and hydraulic engineering and digital microelectronics, making this process the most productive, reliable production line and with minimum maintenance.

The process consists of a number of clearly defined steps, which are chronologically applied on the treated product, providing a manufacturing system that offers the interesting features that are given above.

It contemplates the two most common footwear construction methods: lasted footwear and lasted glove with glued or injected sole, giving the process great versatility because the range of production methods imaginable is, to all extents and purposes, virtually unlimited.

Pallet conveyor plant for automated footwear manufacturing provides notable relevant and advantageous characteristics in respect of known systems, with which an optimum degree of footwear production is obtained. At this conveyor plant a continuous cycle conveyor belt is used, to which the footwear parts are conveyed by the different handling phases: gluing, drying, injecting of soles, pressing, etc., both whether the footwear has injected sole or glued sole.

Among the most important advantages that are to be found in the pallets conveyor line, we can highlight the following:

- Conveyance of palletized soles or bottoms.
- Possibility that, in the desired section, the shoe pallets rotate 90° or more, to allow the footwear to enter the lasting furnace, or tunnels in general, in a longitudinal direction.
- It is possible for a robot to have access to cement three different points, because the conveyor belt includes a conveyor chain of lasts and another of soles or bottoms.
- There is a pallet park for surplus numbers of lasts in production.
- A stock of odd lasts can be kept secured to a turret that can be connected to the pallet; this turret has a chip available in one of its guides, via which information is sent to the robots.
- Only three operators are needed.

The field of the invention is also to provide a stopping mechanism for the pallets that accede to the different job stations worked by robots, where it is extremely simple and reliable to keep the footwear immobile during the robot operating phase.

The individual lasts conveyor pallet for the production of footwear, belongs to an automated conveyor line, whose main feature is the way the last locking and unlocking takes place in respect of the pallet which advances on the conveyor.

Each pallet embodies an electronic memory chip which programmes the operations which the footwear fitted in the last has to undergo, sending the information via the actual pallet turret, to the robots which perform the programmed operations which the footwear fitted in the last has to undergo.

These kinds of pallets can mainly be used in all kinds of footwear production sectors or branches, whether this is footwear for children, men or women, shoes or boots up to 40 cm quarter height.

Among the most important advantages of these pallets, we can mention the following:

- Locking of the last via the inner part of the pallet.
- Information from the last to the robots that is sent inside the pallet.
- Information can be deleted and sent from the control station of the belt to the chip of the last, inside the pallet.
- The last can be locked or unlocked in the same stopping and locking action, by the transmitted information, which is what has reached the stop position.
- It allows extremely high quarter heights to be reached.
- When it is not locked, the last can be removed from the pallet and fitted in it again very quickly.
- The pallet is a strong, sturdy manufacture and consists of two parts: one which is the actual base, and the other which is attached to the last and contains the fitted chip.

Another advantageous feature of the invention is the insole-fitting robot, which is made up of an automated machine integrated and communicated in the same footwear production line arranged in the respective last which accesses at the conveyor chain pallets.

The automated machine which glues the footwear soles is also integrated in this production line, although it can also be used for general gluing operations, in automatic or manual systems for parts in the textile, leather industry, etc.

The field of the invention also embodies a special structure for a lasting furnace or stabilizing of the footwear, which is used for lasting by heat and also for stabilizing by cold, integrated in the same automated production line of the footwear, which in turn offers notable advantages in respect of the conventional furnaces that are preferably used in this footwear sector.

The footwear production line also has a robot to pound-up the edge of the footwear to which it has access mounted on the conveyor chain pallets of the lasts, offering the following most important advantages:

- It has a locking device for pallets with vibrations dampener.
- It includes a shoe fastening assembly, which gives longitudinal pressure, driven by the side cylinders.
- By means of a conveyor dolly, with suspension, the pounding-up head is adapted perfectly to the section of the shoe and to the breaks of the last.
- The pounding-up head has one or two hammers that knock the edge of the footwear.
- One or all of the hammers may carry heating, depending on the type of shoe to be pounded-up.
- All movements are controlled by robots.
- Vision system which distinguishes the type of shoe.
- Rejection system for unsuitable uppers, to avoid them being stored.
- Automated reactivating and storage system.
- Conveyor system for the uppers stacked on a dolly which are kept warm with steam, air or dry heat system, depending on needs.
- Easy system to make the code that controls the characteristics of the uppers, for the artificial vision system.

#### **BACKGROUND OF THE INVENTION**

The pounding-up action of the shoe edge takes place naturally before the roughing and gluing of the sole and achieves a perfect union or gluing of the footwear uppers to the inner sole. The strip that edges the uppers and which has been pounded-up against the inner-sole has a number of folds and reliefs which, after the process, adopt almost a flat shape.

The functional principle of the pounding-up robot is the use of hammer-like parts which, associated with a vibrator device which is driven by the motor of the pounding-up head, submit the entire shoe edge to numerous impacts, with a very high frequency, which produces the pounding-up of this peripheral band on the inner-sole that lies directly on the last.

The invention also contemplates the individual pallet for conveying soles, with locking and stop system, whose main feature is the ease of adaptation and locking of the different types of soles, both in size numbers (from 17 to 26), and in different models (from plain to bandlet for sportswear), and also their use which may be:

- For gluing the sole.
- For halogenating the sole.
- For surface modification system of the matter (by laser or other technique of similar characteristics) as substitute for halogenating or roughing, for a better gluing.
- For control system by artificial vision to transmit the characteristics of the sole to the computer.

Another field of this invention is the fixture position of the pallet in respect of the conveyor chain when the robots are going to work on the sole, adapting perfectly to the base of the pallet, stopping them with a decimal precision.

Other phase in the production process and which requires its respective equipment or automated machine that is connected to the same footwear production line, is the footwear uppers reactivator and inside this the footwear uppers are stored, submitting them here to the initial treatment which consists of wetting and reactivating whatever parts require this, offering very notable advantages over the conventional devices and machines.

Among the most important advantages of this reactivator, we can mention the following:

Various footwear production processes are known today where the phases that are used require a large number of operators to carry these out.

The conventional footwear production systems include different steps that are not versatile enough to be carried out automatically, or to share their performance with others that are done by the same operator.

With these conventional production processes, footwear production is considerably more expensive because labour is very dear and there is in addition a very important wear in materials and a really considerable loss in working time, without forgetting the ample stocks that are produced.

Present-day plants use flexible and automated pallets conveyors, in the production of footwear with the sole, by injection, and there are no sole sequence conveyors that allow the sole to be conveyed to the precise point where it is needed and take advantage of a single robot in the use of the shoe adhesive.

Present-day conveyors do not pass below the furnaces either. To take out the electronic memory chips where the operations that the footwear has to undergo are programmed, the present conveyors do not include a pallets park and another one for lasts. Conventional plants usually consist of a single conveyor belt which carries out the entire operation and contains all the components that form the shoe.

Present-day plants can only use injection molding footwear.

At the traditional product line there must be 8 to 10 operators.

For the individual lasts conveyor pallets, pallets are used today that lock the lasts and send information via the outside part of the pallet, making it difficult to produce footwear with high shanks, western-style boots, or riding boots or simply fashionable footwear with heights.

In these present systems, first the pallet is locked and then the last, and more time is lost in the process.

With regard to machines for fitting inner soles to the lasts, at the moment these are manual and are secured with nails, clips or cement. At the moment no automated machines are known for this work.

There are machines today to cement soles of footwear, which are installed or fitted on the side of the product lines and also individually, requiring a manual handling by one or more operators to proceed to load

and unload the respective footwear; with independent control from the rest of the plant or product line.

Spanish patent of invention number 444.649 is known, for: "Improvements introduced in a press to cement shoes or other parts of respective form", which embodies a pressing pad charged by a pressure agent, where the sole is fixed on flexible membrane to be cemented on the lasted vamp held in a guide for the shoe; this guide incorporating a switch that can be tripped forcibly by introducing the vamp; this switch connects the drive for the closure movement of the active cementing press parts, formed by the pressing pad and shoe guide.

The shoe guide is arranged stationary with the switch which it contains, on the press rack, and the pressing pad is movable in respect of the shoe guide. The shoe guide with the guide switch and pressing pad can in addition be moved towards one another, tilting the pressing pad around a shaft by means of a cylinder, and at the same time in correspondence with it there is a protector bell.

Furthermore, in this patent of invention, the shoe guide is supported by a system of tilting levels, which is operated by a cylinder. There is also a safety gate arranged at the front of the guide which can be moved for the shoe.

The Spanish patent of invention 511.868 claims "Improvements introduced in machines for cementing soles on footwear", where there is a pad with two independent chambers, with prior vacuum in both, and where one of them is closed by a semi-elastic membrane and the other by a super-elastic membrane. The pad tilts on a shaft, thanks to a cylinder drive. In addition, the lasted plate which has a space where the shoe is fitted, is interchangeable.

With regard to the furnaces for lasted or stabilizing footwear, those which are available today have the disadvantage that the conveyor assembly passes and runs inside them, and also the respective shoe which is placed with the lasted part facing upwards. In other furnaces, which are adapted and related with palletized chains, both the chain and the pallets enter them and other related elements, so that the internal cavity or chamber of the respective furnace is too big, and a large amount of energy is consequently needed to heat this cavity to the desired temperature, apart from more time being needed to reach this temperature, and also when wishing to increase it, in the positive or negative sense.

In addition, the machines for pounding-up the footwear, that exist today, are manual ones and in some cases automatic although there are none that lock the pallet to the last at the centre of the shoe height.

The footwear uppers reactivators that are available today are manual and in no way automatic and with an artificial vision system that distinguishes any type of shoe, depending on model, number, foot and colour so it can thus be stored in the same order as they will later be used on the assembly line, controlled by the computer.

## DESCRIPTION OF THE INVENTION

Generally speaking the automated footwear manufacturing process, that constitutes the field of the invention, consists of the following steps:

Firstly, the last that carries information inside informs about the model, number and crown-heel length which is going to reach the robot which will fit the inner soles; this will select the corresponding insole and will fit it on the last, centering it properly. The pallet will then continue on to the conveyor chain or belt until the next stop, where it will proceed to shoe or fit the crowns, heels and shanks; this work is carried out by one or more operators.

As soon as the shoe is fitted, it is again put in the last and continues to move along the pallets chain, where a first rotation of 90° is produced to proceed onto the furnace process and heating. The conveyor belt in continuous cycle transfers the footwear pieces through the different handling steps: cementing, drying, injecting of soles, pressing, etc. Advantageously the conveyance is done according to two continuous closed cycles, in one of which the lasts are conveyed and in the other the soles or bottoms, which cross at different points, depending on the plant design or requirements, so that the lasts conveyor line crosses above the soles. There are also certain sectors of these chains, that, in the form of loops allow their size to be adjusted to suit the drying or waiting times, so that in this way the same robot can carry out different operations. There are systems that produce a 90° rotation of the pallet to enable the footwear to enter the drying tunnels, furnaces, etc. lengthwise, which allows a reduction in their cross section.

Following this process, parallelly, in the pallets chain the soles or bottoms, uppers and in-soles are conveyed, depending on the information that is provided by a computer. When the operator has prepared a lung of approximately 7 minutes, equivalent to approximately 40 loaded pallets, he has time to change the uppers reactivator to the laster of crowns, heels and shanks and the insoles feeder to the robot of inner soles (first step).

It is logically understood that when the soles are fitted on the chain of soles, they have already been roughed or halogenated, although this work can also be done automatically if required in the same production line.

Returning to the lasts conveyor chain process, when the footwear emerge from the furnace where it has undergone a temperature between approximately 80° and 120° C, for a few minutes, the last again rotates 90° and is set as it was previously to automatically enter the zone of the robot that handles the pounding-up of the shoe. The last then continues on to the robot which makes the heel seat (when the shoe is botier type), otherwise it continues directly to convey the last to the six-shaft robot which will proceed with the roughing of the lasted and the side.

After being roughed, the shoe is then moved to the robot stop where the cement is applied, and pre-cementing if required, that is to say, a preliminary base before

cementing. The adhesive can be applied twice taking advantage of a loop in the conveyor chain, so that at the second stop a thicker cement will be applied, and at the same time this same robot will also apply cement to the sole which will be fitted in this zone, conveyed by its respective chain.

Later, both the last with the shoe, and the sole will be unlocked and they will proceed to the driers, where a conventional heat drying process will be applied and flash reactivating.

When they emerge from these driers, the two pallets chains cross again to allow an operator to join sole and shoe. The shoe which is again fitted on the last then undergoes a pressing process for a few seconds to establish a perfect union between shoe or uppers and the recently fitted sole.

The last then rotates 90° again and is introduced in a cold conditioner tunnel from which it emerges automatically to the robot which extracts the shoe from the last which has conveyed it during the entire process, breaking the seal or flange that secures it, and proceeding to empty the finished shoe, whereby the production process is then concluded.

The special design of the conveyor belt or chain to be used in the conveyor is observed, which although of conventional type, offers dimensions that have been designed to guide a certain number of pallets with regard to their speed of movement and furthermore bearing in mind the time needed for the different machines to work suitably on them, with a minimum length of chain and maximum working times, which means that less space is required to house the assembly and greater production speed. Because the conveyance is made by two independent chains, one where the pallets of lasts are driven and the other the sole pallets chain which intercross at certain points according to plant needs or design, total independence is allowed in the handling of the soles and uppers of the lasted footwear on the lasts.

The extensions in the form of loops found in the chain of lasts and soles offer greater versatility, and also allow a reduction in size when smaller chain lengths are needed to obtain pertinent waiting times or drying.

Thus, for example, in these loops, the respective robot can firstly apply a pre-cementing layer, and the shoe then moves along the loop to allow time for it to dry and then the same robot applies the standard (ordinary) cement, and in turn accedes to the soles chain and carries out an operation on that chain.

To get the pallets to stop efficiently at the points where work needs to be performed on the shoe, according to the invention and in a completely simple way, these pallets can be locked by the raising of arms whose ends are fixed into the guides of the pallet, applying them against upper wings of the plant. In this way and because the pallet is slightly raised, it loses contact with the conveyor belt and the footwear thus continues immobile although the chain continues to advance.

In general lines, the individual conveyor pallet of lasts for the footwear production is formed by a rigid

structure that consists of an upper guide to connect the last and for the information terminal, and also other lasted components and stopping notches of the pallet, dependent of the position where this lies on the conveyor.

Connection of the last is performed by means of a part or turret which is secured to the last by screws and can be plugged into the pallet guide.

The last connection system to the pallet allows a fast handling operation, at the entry and exit to the pallet, by an operator or by a robot. It can thus be locked and unlocked quickly and be handled without risk of it coming out of its guide, because it has an automatic auxiliary fastening system, as we will see later.

The chip that sends the information is located in a guide of the turret, and in the event of a fall, it is protected from direct impact.

The locking and unloading motion of the turret which carries the last, in respect of the pallet, is contained inside the pallet, to largely help the work that is to be performed on the different types of footwear, because it allows a shoe and a boot to be worked.

The information that is contained in the chip is sent by a connector located at the top of the turret, through which it passes to a terminal at the side of the platform of the turret for reading. It is all located inside and there are consequently no cables or connections to hinder the work on the pallet.

The guide at the top of the pallet for connecting and securing the turret has a prismatic shape the same as the connecting end of the turret. Connection is made because the front and lower part of the turret includes gears that can be inserted in a lower notch of the guide of the pallet, when the turret is shifted sideways, after the insertion has been made, assisted by a spring-loaded system. This moreover has a locking/unlocking motion of this connection of the turret to the pallet, defined by a rod which vertically crosses the pallet and is driven by a lower loader. When this rod is lifted against a recovery spring, it emerges to the receiver guide of the turret, and is placed between the rear part of the turret and the wall of its guide. Until the rod is withdrawn, the last locking is thus assured.

With this layout, when the pallet is locked by stopping at an operations station, no external clips are needed to secure the pallet, allowing the robots to work.

Once the pallet has stopped and is locked, it has a terminal at the bottom which connects at the bottom with the chip of the last, contained in the turret, and it can send the necessary information to any robot without worrying about what type of footwear is made, by means of a reader.

Because information can be deleted and sent from the control station of the chain to the chip, from the inside of the pallet, the information can be modified or increased from the control station of the chain, without having to remove the manufacturing last, or handle other elements. Information can be given or removed at a station that is created for this purpose and which is control-

led by the industrial computer and its software created for this purpose, in a fully automatic and reliable manner.

In the same action of stopping and locking the pallet, from the information that is transmitted it can be recognized that such-and-such a lasting model, number and shoe size has reached this stopping station, and also which model of uppers it has, with what kind of leather it is being made and what model of bottom or sole is going to be cemented and also in what material it is made or under what conditions this is done.

Other of the advantages we have listed above, is that extremely tall quarter height shoes can be made, and it is also possible to design injected sole shoes and also cemented soles, of any kind and with any uppers that fashion requires, be these heights, boots or otherwise; this is possible because the locking and information pass inside the shoe and in no way influence or affect the model that is going to be produced.

The mechanism which is designed for introducing the turret with the last in the pallet, when the locking rod does not operate, allows a far easier connection without affecting the insertion zone (case of heights), because the place of insertion can be made easily and very quickly.

Because the pallet comes in two parts and with a strong, reliable connection system, it can work perfectly with robots, non-stop, without creating any problems at the different work stations, so that when the last is extracted from the base pallet, it always incorporates the necessary information in the chip and in this way avoids the possibility of making errors, by inserting another last on the pallet, or carrying out work on the single last, outside the pallet and conveyor chain.

The incorporation of a novel part is also foreseen which acts as union between the last and the pallet, and is attached to the last in a stable way. In this case, the pallet incorporates a shaft which acts as locking element on the intermediary part. The unlocking rod crosses the entire pallet and this hollow shaft, unlocking the last by shifting it endlong.

In general lines, the insole-fitting robot which forms another of the basic automated stations of the plant, is made up of the following fundamental elements:

- Un round feeder where all the inner soles are stacked, and which are needed for the product line.
- A cushioning head which is in charge of taking the respective insole from the round and conveying it longitudinally until it is delivered on lasting plates, - making it first go through cement injectors at the desired height for a perfect use of the cement on the insole.
- There is a loader which will lock the last to unlock it.

The inner soles that are stacked on the round feeder, are stocked by pallets that carry these soles, which embody magnetic fingers that work as guide and lasting pillars, and there is also a possibility of arranging them according to the geometric shape of the insole.

The most important advantages of this robot are as follows:

- It places the inner soles automatically, without needing manual labour.
- The round feeder is made up of a round, divided pallet holder table, depending on the job numbers that are needed, and easy changing pallets, which contain the magnetic fastening and lasting elements.

There is a cushioning head of inner soles, with two movements: upright to pick up the insole and cross travel to convey it, and there is also the possibility of regulating the large or small cementing zones of the inner soles, to approach or separate from the cement injectors.

This conveyor head places the insole, after cementing it, on the last, a few millimeters from it, without touching it.

- By means of the lasting clips, which operate when the insole is at a short distance away, these centre it perfectly in respect of the last, adjusting it and lowering it for a perfect cementing.

There is an air-operated finger which releases the last from the pallet.

- A programmable robot, which controls all the programme movements which the chip that is coupled to the last transmits to it, for execution.

Referring now specially to the automatic machine with which the cementing of footwear soles is performed, we can see that compared with conventional methods, it is advantageously included in the same product line, automatically making the loading and unloading by pallet in line, without requiring manual handling, at the same time as the cementing chamber has double flange membrane; this cementing chamber is quick changing; the control is integrated in those of the automated product line.

It consists of a structure that is made up of a quadrangular base, from which four slightly sloping pillars run upwards, which are joined at the top to a bridge that supports the cementing chamber.

In addition there is an adjustable table to adapt to the different lasts and sizes, which is also divided to enable a device to open and make way for the last and lasted footwear on it; this opening and closing motion is carried out by means of air-operated cylinders which drive arms or legs that support the table. The arms have an articulation at their lower ends and a spindle with a nut which is operated by a transmission and reduction motor which has an electrical brake, that regulates the height of the work controlled by the integral control of the plant. With all this, the table opens and closes, and can be adjusted in height depending on the manufacture.

The cementing chamber which is molded and cast in injected aluminium, is supported by the upper bridge

of the described structure, where different kinds of membrane can be fitted on this chamber, mainly double flange. For a better performance, the chamber assembly has a control system, for up or down control, worked by a transmission and an electrical motor with electrical brake incorporated. With the double flange membrane, the pressure on the sole and that of the band may be different off-phase in time for adapting depending on the type of sole to be cemented, which achieves a superior quality in the different production types. Control of the electrical motor is made with the integral line control.

The machine thus receives the last with the respective footwear by means of the pallet which is conveyed via the product line chain, so that when the last reaches the machine, it waits with the table open and cementing chamber at the top. Because this is centered in the machine, it closes the table and the chamber drops and enters the lasters and locks the assembly, giving the signal at that moment to the electric operated valves for the compressed air to enter the cementing chamber, passing first via a sequence valve to provide prior pressure to the sole, to later immediately proceed to the contour; equalizing the pressure that both increase, causing a regulation in accordance with the respective type of footwear. Pressure is maintained for the amount of time established in advance and once the cementing has been made, the pressure is removed. The cementing chamber then goes up and the mixture opens to allow the last holder pallet to emerge and the next one to consequently enter, and so on successively.

Referring now to the structural characteristics of the lasting furnace or stabilizing of footwear, we can say that, as compared with known furnaces, this is also integrated in the product line, because it has a chassis or rack formed by a metallic structure at the top of which the furnace is fixed, which has a heating chamber which communicates with the outside by means of a narrow longitudinal lower opening, protected or covered by a curtain to avoid where possible the outlet or release of heat produced inside.

With this layout, the chain that conveys the pallets that carry the lasts of the shoe, advances and moves under the furnace and enters this rack, so that only the lasts, with the corresponding shoe, pass inside the heating chamber where it will remain for a suitable time until the required temperature is reached, which will occur in a very short space of time, because this heating chamber has a relatively small volume and the energy employed will also be small and put to very good use.

All this has a positive effect with a notable increase in productivity, and also an important saving in energy.

To pound-up the shoe edge, the automated machine of the robot offers the notable advantages that have been described above in respect of existing machines and both function and automated machines. It is very easy for the robot to adapt to the shape of the footwear, performing a homogeneous and fully automatic work.

This robot is integrated in the automated product line which conveys the shoes, linearly, that are already in the

last and on their pallets, and on the conveyor line which feeds, pallet by pallet, this pounding-up robot, which receives information about the type of shoe it has to pound-up, and operates as programmed, applying the suitable pressure and fit, without at any time requiring manual labour.

It consists of a metallic structure, defined by a base that can be secured to the floor or else supported on floats or rubber-blocks which dampen vibrations. Four oblique pillars emerge from this base which are joined at the top in pairs and at these cross pieces there are two cross rods which materialize the sliding guides of a conveyor assembly formed by a rotary head driven by a motor. A dolly moves along these guides, from which the pounding-up head hangs, which hits the edge of the lasted arranged on the last, assisted by its respective vibrator motor. The pounding-up head can carry out longitudinal, cross travel and vertical movements because the conveyor unit is assisted by cylinders and springs, and the hammers adapt to the concave and convex curves of the shoe and absorb any irregularity which it may have.

With this assembly, when the pallet enters in the pounding-up machine, the stopping system locks the pallet, worked by a sensor, and the shoe fixture unit is enabled, operated by two side cylinders anchored to cross members of the metallic structure, supported on rubbers to avoid marking the shoe crown and heel. The conveyor assembly is then started up which leaves the hammers at their initial position to commence pounding-up, and the hammering programme then begins, rotating on the entire shoe until the last is set at the desired angle.

At the end of the entire cycle, the pounding-up head returns to its initial setting and allows the pallet to leave, to wait for the next one.

In general lines, referring to the individual pallet for sole conveyor and which embodies a locking and stopping system, this offers the following important advantages:

- It can hold soles of any size number and foot (left and right).
- It can hold any model of soles.
- Very easy and quick to fit and with decimal precision.
- Different kinds of jobs can be carried out on it: cementing, halogenating, surface modification and control by artificial vision.
- When work is to be carried out on it, it is locked with a stopping system that sets it with decimal precision.
- The pallet is of a strong manufacture and consists of two parts: a base and an interchangeable fastening assembly.

This conveyor chain of soles passes through each of the robots, where some job has to be performed. When it reaches them, the pallet fixture system comes into operation which, by means of a fixture piston, leaves it tightly locked, and with great precision so that the per-

tinent programmes can be developed with repetition and without moving.

Once the job is over, the computer gives the order to the fixture station to disable the fixture piston so that the pallet can complete its cycle. The fixture station of the pallet is defined by a pillar that is secured by a base to the ground, below the conveyor chain, and this pillar is finished in a "U" bracket at the branches of which the pallets move. One of these branches embodies a side piston that secures the base plate which materializes the surface of the individual pallet.

At the top this base plate embodies a number of orifices that occupy an extreme portion of its rectangular area. At the other end it includes a notch or longitudinal notches for the guiding of a part or accessory that secures the soles, which works in combination with another accessory that has previously been located in one of the orifices of the base plate, whose position has been selected dependently from the sole size.

Another accessory that secures the sole, which can be used for small sizes, is determined by a clip which can rotate at one of its end, precisely where it is crossed by a shaft screw which in turn passes through one of the plate orifices. The clip is assisted by a torsion spring which establishes side torsion on the sole, by means of a fluted section cam which is exchangeable. The sole is secured when it rests on a flap or dismountable side wall of the base plate.

Lastly, referring now to the structure of the footwear uppers reactivator, we can see that in general lines this is integrated in the automated product line, identifying each type of uppers and storing it in an orderly manner inside the load unit, by means of a control by artificial vision, thus offering the notable advantages which we have listed earlier. The storage system inside the load unit is orderly, depending on whether the computer that controls it has been programmed. When the uppers enter the reactivator, with access from a pallets conveyor, this is secured by the palleteer which defines the loading station in which the successive footwear uppers are going to be stacked on a pallet that can be moved vertically. The rear part of the palleteer secures the uppers and this in turn is secured by a special clip located at the front, thanks to which the thickness of the leather of the uppers is controlled.

This front zone of the uppers is in turn positioned under a video camera, and when the uppers are illuminated at the bottom with a lighting system, the size number, foot and model and also the colour of the leather are also identified.

These identifications are given by a code marked on the edge of the uppers of the footwear and which has been made at the time of the clicking, and consist of a number of notches performed along the edge, defined by a binary code and located in a specific place to be read and transmit all the information to the computer.

The identification of the colour of the leather is sent directly to the computer by means of the artificial vision.

After all the characteristics of the uppers have been picked up, if the computer approves this, it is assimilated towards the inside of the loading station, where they are going to be stored, in an orderly way, for later assembly.

This station, in turn, is in charge of reactivating the uppers by steam and heat, depending on the type of leather and characteristics.

If there is any unsuitable upper, which the reader system does not consider valid, this is automatically rejected and the loading station does not assimilate it, giving the signal for it to be replaced.

When the first pallet is complete in the inspection and loading station, this pallet with all the stacked uppers is conveyed to a nearby dolly where it is stored and where the reactivation is being carried out.

This dolly can fill up to three pallets of uppers stacked in pairs and is the element in charge of keeping them at the optimum temperature and conveying them to the station of use, where they will be lasted, in the order marked by the programme and which have already been placed by the inspection station.

Up to 200 pairs can be conveyed on this storage dolly, which can be replaced by another when it has been emptied.

With this vision and storage system of uppers, a synchronization is achieved and great speed at the time of handling, in the lasted, after its subsequent manufacture in the automated footwear line.

To facilitate the understanding of the characteristics of the invention and forming a full part of this descriptive report, some sheets of drawings are included in whose figures, given by way of illustration only and not limited to these, has represented the following:

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

**Figure 1.-** This is a diagrammatic view of the conventional system for manufacturing the lasted shoe, where a large number of operators intervene.

**Figure 2.-** This is a diagrammatic view similar to figure 1, of another conventional manufacturing system of lasted sports footwear, where shared operations cannot be carried out automatically.

**Figure 3.-** This is a diagrammatic view of a plant in which the manufacturing system of lasted sports footwear can take place, in accordance with the invention, affording great versatility and a notable increase in production.

**Figure 4.-** This is a diagrammatic view, similar to figure 3, of the lasted shoe production process, in accordance with the invention.

**Figure 5.-** This is a diagrammatic plant view of the pallets conveyor plant for the automated footwear manufacturing.

**Figure 6.-** This diagrammatically shows different positions of the sequence of movements to obtain rotary motions of 90° on the pallets, when they reach the points where this movement has to be carried out.

**Figure 7 and 8.-** These are respective raised views of the stopping motion of the pallets, in the "locked" and "unlocked" settings, respectively.

**Figure 9.-** This is a raised selected view of an individual lasts conveyor pallet for the automated footwear manufacturing, in accordance with the invention, including the last and the conveyor chain of the different pallets; this view corresponds to a cross-section in the direction of movement of the chain.

**Figure 10.-** This is a raised view, similar to figure 9, without including the last and its connecting turret to the pallet, nor does it include the conveyor chain.

**Figures 11, 12 and 13.-** These are respective raised side sectioned views, lower plant and upper plant of what is shown in figure 10.

**Figure 14.-** This is a raised sectioned view of the turret or element that connects the last to the main section of the pallet.

**Figure 15.-** This is a section via the A-A upper line of figure 14.

**Figures 16 and 17.-** These are respective sectioned raised and lower plant views of the part that acts as union between the pallet and the last, in an alternative form of embodiment in respect of figures 9 to 15.

**Figures 18 to 22.-** These are different views of the connecting parts of the turret, in this second form of embodiment, in accordance with figures 16 and 17.

**Figure 23.-** This is a sectioned longitudinal raised view of the individual lasts conveyor pallet, with the different lasted elements, in accordance with this second form of embodiment.

**Figure 24.-** This is a longitudinal raised view of the sole-fitting robot, in accordance with the invention.

**Figure 25.-** This is a plant view of what has been shown in the figure 24.

**Figure 26.-** This is a perspective view of one of the pallets that carries the insole incorporating the fingers or magnetic pillars for centering the stack.

**Figure 27.-** This is a perspective view of what is shown in the figure 26, to observe the lower side of the pallet.

**Figure 28.-** This is a raised view of the automated machine for cementing footwear soles, in accordance with the invention.

**Figure 29.-** This is a section view of the automated machine of figure 28.

**Figure 30.-** This is a plant view of the same machine as shown in the figures 28 and 29.

**Figure 31.-** This is a diagrammatic raised view of the lasting furnace or footwear stabilizing, in accordance with the invention.

**Figure 32.-** This is a front view of the same furnace of the figure 31.

**Figure 33.-** This is a cross raised diagrammatic view of the robot for pounding-up the shoe edge in accordance with the invention.

**Figure 34.-** This is a longitudinal side raised view of what is shown in figure 33.

**Figure 35.-** This is a perspective diagrammatic view of the lower face of the footwear, to see the zone for pounding-up.

**Figure 36.-** This is a perspective view of the base-plate which materializes one of the individual pallets to convey soles, in accordance with the invention.

**Figure 37.-** This is a perspective view, similar to the figure 36, with the pallet complete with the dismountable side wall, including a fixture system for the sole, different to the one used in the figure 36.

**Figure 38.-** This is a cross raised view of the individual pallet for sole conveyor, integrated in the automatic conveyor chain, precisely in the zona occupied by the fixture position or stopping of the pallet, when the pertinent fixture piston is operated.

**Figure 39.-** This is a plant view of the footwear uppers reactivator, in accordance with the invention, which includes the actual conveyor and reactivating unit and the load unit and control by artificial vision and initiation of reactivating.

**Figure 40.-** This is a partial raised view of what is shown in the figure 39.

**Figure 41.-** This is a perspective view of what is shown in the figures 39 and 40.

**Figure 42.-** This is longitudinal raised section of the footwear uppers reactivator, to observe the inside of the loading and conveying station.

**Figure 43.-** This diagrammatically shows three phases of the storage process of the upper identified and accepted as valid.

**Figure 44.-** This is a partial view of the implementation of the upper of the footwear, specifically at the front where there are the identification marks of the characteristics of the upper.

**Figure 45.-** This is a partial view of the implementation on self-adhesive paper of the different binary codes for identification of the characteristics of the upper, arranged in strips which must be adhered to the uppers clicking knives.

**Figure 46.-** This is a perspective diagrammatic view of one of the clicking knives that has one of the binary code strips partially adhered as shown in the figure 45, corresponding to certain characteristics of the shoe.

#### **DESCRIPTION OF THE PREFERRED FORM OF EMBODIMENT**

Referring to the numeration adopted in the figures and more specifically in relation to figures 1 where the present manufacturing process of the lasted shoe is shown, to produce 90 pairs per hour, we can see that the assembly line is started by means of operator 1, where the different work stations are occupied by respective operators referenced as number 2.

Reference 3 designates the machine for nailing inner soles, reference 4 the machine for assembling crowns, reference 5 indicates the machine where the heels and shanks are assembled, and reference 6 corresponds to the pounding-up machine. References 7 to

10 designate respectively: the uppers reactivator with lasts and soles, the reactivator of the heel-pad, the last-  
ing furnace and the conveyor towards the machine for  
roughing the lasted, the latter referenced as number 11.  
By means of another conveyor belt 10 the product  
reaches the next operator 2 who performs the cementing  
of sole and shoes at the work station referenced as  
number 12.

Reference 13 indicates the zone where the drying  
of glue takes place reactivated by flash. Next comes the  
press 14 and after going through the cold stabilizer 15  
another operator 2 proceeds to break yarns and extract  
the shoe from the last; this job is carried out at post 16.  
On conveyor 17 the shoes are conveyed, and conveyor  
18 again drives the lasts so that a new cycle can com-  
mence.

In the conventional diagram of figure 2, we can see  
how a numerous series of steps are also carried out, sim-  
ilar to those of the figure 1, and also including machine  
19 to mark the sole of the sports shoe and machine 20  
for roughing the side. At work stations 21 and 22  
attended by three operators, the shoe and sole are  
cemented.

Referring now to the figure 3 where the manufactur-  
ing process of lasted sports footwear is shown in accord-  
ance with the invention, we can see how the process is  
automated, requiring only three operators 2, instead of  
the twelve in the conventional system of the figure 2.  
There are two conveyor chains 23 and 24 which perform  
continuous closed cycles. The chain 23 conveys the lasts  
on pallets 25 whilst the soles or bottoms advance on the  
conveyor chain 24 on the pallets 26. The conveyor chain  
23 crosses above the 24, and it can be observed how  
there are various crossing points, and also sectors where  
there are loops in one chain and in the other chain. Dry-  
ing zones or waiting time can thus be determined in these  
loops and also that a same robot can firstly apply a pre-  
cementing film and after the shoe has advanced along  
the loop to allow time for it to dry, again apply the stand-  
ard (ordinary) cement and also accede to the conveyor  
chain of soles to make a third operation.

Following the chronological order of the different  
steps, in the diagram of the figure 3 which shows the  
manufacturing of lasted sports footwear, we can see that  
the robot 27 will fit the respective inner soles in accord-  
ance with the information that is conveyed in the actual  
last, on it. The information arrives via a chip inside the  
actual last. At the next stop, the crowns, the heels and  
the shanks are fitted; this work is carried out at stations  
28 and 29 by a single operator.

The shoe assembled in the last continues to slide  
along chain 23 and at point 30 it rotates 90° to become  
introduced in this correct position in the furnace 31.

Reference 32 shows the supply position of the  
insoles, uppers and soles, according to the information  
that a computer supplies the operator. This operator is  
allowed time to load the order of forty pallets and to  
change the uppers reactivator to the laster of crowns,  
heels and shanks, and is also in charge of loading the

inner soles on the inner soles robot, of the first mentioned  
step.

The robot 33 receives the shoes which come out  
from the furnace, once the pallet has rotated again, and  
is in charge of pounding-up the shoe.

The last then continues its route until it reaches the  
six-shaft robot 35, where the lasted is roughed. Robot  
34 roughs the side.

Robot 42 cements side and lasted. Reference 43  
shows the aspirator of the roughing robots, and the ref-  
erence 44 the cement tank.

The shoe continues until the stopping of the robot  
36 to receive cement (in one or two phases), and this  
robot also gives cement to the sole which will be placed  
at point 37 of the soles conveyor chain 24.

Later, both the last with the shoe, and the sole will  
be unlocked, progressing towards driers 38 and at the  
outlet we can see how the two chains 23 and 24 again  
intercross to enable the third and last operator 2 to join  
sole and shoe. The shoe is then put on the lasts again  
and subject to a pressing motion on the machine 39.

The last again rotates 90° and is introduced in the  
cold conditioning tunnel 40, where it is later received by  
the robot 41 which extracts the shoe from the last which  
has conveyed it throughout the entire process, breaking  
the seal or flange that secures it, whereupon the process  
is thus completed.

In the figure 4 we can see that in accordance with  
the invention, the process for manufacturing lasted shoe  
is shortened yet further. Compared with the conventional  
system of figure 1, the number of operators are reduced,  
from nine to just three.

At the outlet of robot 33, the last proceeds to robot  
45 to do the seat, when this operation is required.

The fourteen most essential points of this manufac-  
turing process, are as follows:

- Pallet with locking and information inside the shoe shank.
- Chip, bubble or active label communicated with the "pc" or computer at each last.
- Continuous flexible conveyor, with stops that lock the pallets, at their base, allowing work with robots with complete freedom and precision.
- Robot for inserting soles, automatically, integrated in the chain.
- Furnaces incorporated within the system and where the entry and outlet is fully automatic, without manpower.
- The pounding-up robot, integrated in the conveyor line, fully automatic.
- Six-shaft robot which rough lasted and side and others which cement lasted, side and soles, automatically integrated in the chain.
- Drying of cement and reactivated flash, integrated in the system, which does not have to be inserted or removed, in other words is fully automatic.
- Press which is incorporated and integrated in the system and where the shoes do not have to be taken

out from the press, because they are automatically emptied.

- Shoe delasting robot integrated in the conveyor line, which delasts the shoe, first unlocking the last and later locking it, if necessary, and breaking the thread or seal that secures the upper.
- Computer which connects with robots and orders the memory recording of the chips, bubble or active label and communication software.
- System for lashing footwear uppers, glove or lasted, with self-degradation, to avoid anybody breaking the threads. This is broken with the robot that extracts shoes.
- This includes uppers reactivator, with control of entry of uppers, in order of number, foot size, model, etc., automated and connected to the "pc" or computer of the line.
- This counts on a pallets park to store certain pallets as long as is necessary, which if required, is connected to an automatic laster to be able to change the required lasts of the pallets, automatically.

To increase the productivity of the robot 36 (see figure 4), this will be complimented with a robot or table 46, that has movement on three shafts, thus avoiding displacements of the uppers conveyor line to that of the soles.

In addition, the manufacturing process is completed with the following additional steps:

- By means of a cleaning system 47, the dust produced in roughing step is eliminated.
- A piston 48 anchors the lasts by impact on the pallet, and in this way the force applied on all the lasts is regular and with similar adjustment.
- If this assembly were to be performed by hand, the operator would not apply the same tightness to all the lasts.
- A control 49 on surface union of the soles is established, which verifies the correct coordination between shoe and sole conveyance to avoid off-phases that would hinder the manufacturing process.

Lastly, as an option, it is foreseen to fit a robot in the zone marked as number 50, on the left of the figure 4, which would exchange the lasts automatically, choosing the suitable shoe to be manufactured from the lasts park or warehouse.

Referring specially now to figures 5 to 8, and in particular figure 5, we can see, referenced with numbers 51 to 54, the different warehouses of lasts, pallets, soles or in-soles and bottoms, the last two being intelligent and with quality control.

References 55 and 56 designate the zones of the conveyor chain where there are loops. In this plant, the uppers reactivator has been given the reference number 57.

In this figure 5, the robot 57 positions the last in the machine for injecting soles 58 and from this machine to the conveyor chain 23. In the left part of figure 5, we can see, with reference number 59, the robot that positions the lasts situated in the pallets warehouse 52.

As we have already explained earlier, the pallets must rotate 90° for the footwear to enter longitudinally and not crosswise in the drying tunnels, furnaces, reactivators, etc. The system that produces this is represented in the figure 6 and consists simply of an element that detects the approximation of the pallets to the point where the rotary motion must be made, ordering the raising of a stub 60 which is introduced in a guide on the lower side of the base 61 of the pallet, securing it at one of the corners so that the driving motion of the belt 23 automatically produces the desired rotary motion, as shown by the sequential order of the four positions in this figure 6.

At those points where the 90° rotation is made, in the respective direction, there is a re-widening of the conveyor chain, referenced as 30. When the turning cycle concludes, the stub 60 drops.

In the figures 7 and 8 we can see the stopping motion of the pallets 25 which access the work stations where some operation has to be performed on the shoe, and which merely consist of a cylinder 62 that originates the raising of the arms 63 whose ends are embedded in guides on the base 60 of the pallet 25, locking it against upper wings 64 of the fixed structure 65. In the figure 7 the locking position can be seen and in the figure 8 the unlocking position.

In the locking phase, the pallet 25 is slightly elevated in respect of the conveyor belt 23, so the latter can thus continue its course.

With special reference to the figures 9 to 15 where one of the preferred forms of embodiment of the individual lasts conveyor pallet is shown, referenced earlier on in general with number 25, we can see that it includes a main section 66 and an upper portion 67 or turret which is interconnected with the previous one, as shown in the figure 9. The last 68 is secured to the turret 67 by screws that pass through its orifices 69.

Reference 23 designates the conveyor chain on which the pallets 66 advance. For the robots to work on the shoe arranged in the last 68, pallet 66 is stopped and locked, and is detached from the conveyor belt 23, as shown in the figure 9.

Pallet 66 has a guide 70 at the top that connects the turret 67, which contains a bushing 71 that reinforces the walls against breakages and wear, and which has a lower notch 72 (see figure 10) that receives the cog 73 of the turret (see figure 14).

In addition, the turret 67 embodies an orifice at regular intervals 74 where the automatic auxiliary fixture system is located, consisting of a laster and a spring, where the free end of the laster is inserted in orifice 75 of the prismatic bushing 71. The pressure by this spring obliges that, once the turret 67 is perfectly inserted in the guide 70 of the pallet 66, it moves sideways so that its

cog 73 is inserted in the notch 72 of the bushing 71, thus acquiring the connecting position of the figure 9.

Locking takes place with the raising of rod 76 which vertically crosses the main section 66 of the pallet 25, and is activated by the loader 77 and by means of the base 78, against the action of the recovery spring 79 of the initial unlocking position. As is observed in the figure 9, the upper or active end of the rod 76 breaks into the guide 70 of the main section 66 of the pallet, and is inserted between both sections, preventing the cog 73 from coming out of the notch 72.

The information terminal, materialized by the electronic memory chip, is referenced as number 80 and is located on guide 81 at the bottom of the turret 2. the base or bottom of the guide 70 of the main section 66, has another space that contains the part that carries the connector 82 of the chip 80, passing the information via the cable 83 which crosses the centre of the pallet 66, passing via the lower channel 84 of the base of that main section, to join the information terminal 85 (see figure 12). The reader 86 (see figure 9) transmits the information to the robot which has to handle the footwear that is found in the last 68.

Reference 87 of the figure 10 designates the socket of the laster of the pallet 66, and reference 88 shows the notches of the lower end of the pallet, to make it possible to change their position by a rotary device of the plant, which is not shown in the figures.

With special reference to figures 14 and 15 where the geometric shape of the turret 67 is shown, in this example of preferred embodiment we can see that reference 89 designates a lasting orifice to mark the correct position of the last 68. In the intermediary zone of the turret 67, as is shown in the figure 15, there is a spindle section towards both sides, and also central notches to facilitate and guide their entry in the drying tunnels or plant furnaces, thus preventing an unnecessary loss of heat.

With this arrangement, the pallet is locked at the points where some operation has to be performed on the shoe, because the lasting pins are included, preventing any movement of the pallet. In turn, the interior mechanism is enabled on the main section 66 of the pallet 25, which locks the last-turret connection, also preventing its movement in all directions. The information of its chip 80 is then read and the pertinent operation is consequently performed on the last 68 which this pallet 66 carries.

In the figures 16 to 23 where an alternative construction embodiment of the pallet 25 is shown, we can see that an improvement is introduced in the form of joining the last 68 and the main section 66 of the pallet.

A novel part 90 is used, which acts as join between the above two elements. This part 90 is joined to the last 68 in a stable manner, with screws or any other means or even inserted in it.

In this case, the pallet 66 incorporates a shaft 91 which is slightly tapered and hollow, which acts as locking element of the joining part 90, when introduced via the conduit 92, which is also of tapered configuration.

The unlocking shank 93 transverses the whole of the pallet and shaft 91, to unlock the last when an upward endlong movement is applied from the stopping on the manufacturing line.

The part whose plant view corresponds to the figure 19 and whose raised view we can see in the figure 23, is a base where the unlocking rod 93 is associated and which forms the zone where its endlong raised system operates, in this example of alternative embodiment.

Referring now to the figures 24 to 27 where the structure of the insole-fitting robot is shown, we can see that this is integrated in the footwear product line, where the footwear accedes to the station occupied by the robot, mounted on the respective last 68 solidary to pallet 25 of the conveyor. Pallet 25 remains completely immobile and separate from the conveyor chain during the time that the robot works on the footwear.

Reference 95 designates the round feeder where the inner soles 96 are classified arranged on different stacks, as we can observe in respect of the figure 27.

The cushioning head is referenced in general with number 97 and carries the suction pads 98 that take the in-sole 96 to be carried along the bridge 99, to the other end of the robot, passing first through the cement injectors 100, as we have previously indicated.

The cushioning head 97 leaves the insole on the lasting plates 101.

Reference 102 designates the loader element which knocks the last to unlock it in respect of the pallet so that the operator who carries out the lasted can separate it from the pallet easily and quickly.

In the figure 25 we can see a plant view of feeder 95 which operates in a rotary motion when it receives orders from the last 68, which reach it, to select the number and foot size of insole which must be fitted. Only one operator is needed to reload the pallet when it is empty and who is the same operator who is in charge of the "pc" and changes the uppers reactivator and places the soles on the soles pallet.

The round feeder 95 has a round table, integrated in the machine, which rotates driven by the respective motor to select the type of in-sole 96 that is needed. It is divided into pallet holder and pallets 103 that can be easily changed. In figures 26 and 27 we can see the geometry of these pallets 103 and how they have magnetic fingers or tubes 104, carriers of high power magnets and which act as guide to correctly position the inner soles 96. More than twenty inner soles can be stored on each pallet 103.

Independent of the position adopted by the feeder 95, the head 97 will take the respective insole in accordance with the previously established programme, selecting each model according to the orders received from the chip. These are quickly dismantled (without screws or hooks) and can be rapidly changed for other pallets, when these wear out.

When the head 97 receives the information, it is placed at the programmed measurement and ready to go down so that its two suction pads 98 pick up the insole

96. Once this has been picked up, they are conveyed longitudinally in the direction of the last 68, passing first by the cement injectors 100. The head 97 then continues its cross travel until the insole is positioned above the last, without touching it. Once the head 97 is in position, containing the insole 96 above the last, with a certain tolerance, the position-ing dollies 101 operate lengthwise, centering the insole 96 in this direction. Immediately after this four air-operated fingers come into action which center it widthwise, leaving it perfectly positioned so that upper checks adhere the insole to the last with precision, which is done after eliminating the vacuum action of the suction pads 98.

The round feeder 95 can incorporate various soles and not just one, as we have shown in the figure 24. In this case, the upper round feeders will have a radial interruption on their surface, to allow the suction pads to have access to the lower bottoms.

The possibility of eliminating the glue spray-nozzles 100, is also contemplated, using lasts 68 that incorporate some small oblique spikes that retain the insole 96, without avoiding their easy extraction thanks to the sloping layout which they adopt.

In the figures 28, 29 and 30 the structure of the automatic machine that is used to cement the footwear soles can be seen, in accordance with the invention. This consists of a quadrangular base 105 which acts as support for an adjustable table 106. Slightly sloping tubular pillars (uprights) 107 depart upwards from the corners of that quadrangular base 105 (uprights), which are joined to an upper bridge 108, which supports a cementing chamber 109, forming the quadrangular base 105, the tubular pillars (uprights) 107 and the upper bridge 108, the machine structure, where on the other hand these three parts are manufactured, with hot rolled sections.

The table 106 located between the pillars 107 has a regulation system to adapt to the different shapes and sizes, which is divided into two parts and each fixed to two couples of arms or legs 110, each of which is related by means of an air-operated cylinder 111, where these arms are articulately coupled at the bottom, to a support 112 by means of pins 113. Each support 112 is solidary to an upright spindle 114 coupled to a nut 115 which has a gear ring 116 where a chain 117 is engaged coupled on the other side to a pinion 118 fixed to the shaft of a reduction motor 119 with electrical brake. Naturally, each nut 115 can rotate freely to raise and lower the table 106 and position it at the necessary height, at the same time as these nuts 115 are locked and secured endlong by a ring 120 screwed to a tubular prolongation 121 fixed to the quadrangular base 105.

On the other hand, at the upper bridge 108 there is a second vertical spindle 122, which goes up and down by means of a motor 123 which transfers its rotary motion to a nut 124 screwed on this vertical spindle 122, at the same time as a gear ring 125 is fixed to it where a chain 126 is engaged, associated with this motor 123.

At the lower end of this vertical spindle 122 the cementing chamber 109 is connected by means of a pin

127, which has a double flange membrane 128, that can easily be exchanged if necessary, and at the same time this provides a guide 129 for the corresponding footwear 130. This nut 124 is fixed endlong by means of a ring 131 screwed to the upper bridge 108.

On the other hand, the machine of the invention includes side protections 132 in fine plate.

At the top of the table 106 there is a plate and supports 133 where the footwear 130 rests.

Once the table 106 is set at the required height then, this is the time for the machine to receive the last with the corresponding footwear by means of the pallet which it conveys through the manufacturing line chain, so that when the last approaches the machine, it waits with the table 106 open and the cementing chamber 109 down, entering the lasting and locking the unit, giving the signal at this moment to the electric operated valves for the compressed air to enter the cementing chamber 109, passing previously via a sequence valve to give prior pressure to the sole, to immediately pass to the contour, and matching the pressures so that both go up at the same time, causing a regulation in accordance with the type of footwear. The pressure is maintained for the time fixed in advance and once the cementing has been done, this pressure is removed. The cementing chamber 109 then goes up and the table 106 opens to give an outlet to the last carrier pallet and enter the next and so on successively.

The table 106 which is divided into two parts, is opened by means of the air-operated cylinders 111 connected to the corresponding arms 110 to give way to the carrier pallet to enter and leave, once the cementing operation has been done.

Referring now to the numeration adopted in the figures 31 and 32, the lasting furnace or stabilizing of footwear embodies a chassis or rack 134 defined by a metallic structure formed by two alignments of upright pillars 135 and other horizontal or transversal ones 136, fixing at the top of these upright pillars 135, the actual furnace 137 which has a central heating chamber 138 that communicates with the outside via a narrow lower longitudinal opening 139 protected by a curtain 140 to mainly prevent the escape of heat produced inside and also to help maintain the necessary temperature. The rack 134 is covered by plate or covers that enclose, inside, the mechanical and thermal system that produces the heat or cold, depending on the lasting furnace or stabilizing.

On the other hand, the rack 134 which supports the actual furnace 137 is advantageously integrated in the manufacturing line of the footwear, so that between the upright pillars 135 and beneath the furnace, the conveyor chain runs, which contains the pallets with the footwear lasts, so that when the chain advances, it is introduced inside the heat chamber 138. Cylinders 141 have been foreseen that retain the pallets when these are in any position along the chain, not attached to it because this does not stop at any time. Thus, when each last with its respective footwear is found inside the heat chamber, the

holding cylinders 141 will trip for the footwear to continue inside this chamber for as long as is necessary.

We must remember that both at the entry to the furnace and at the exit there are rotary stations of the pallets, producing a rotary motion of 90° for the lasts, along with the footwear, to pass from the crosswise position they have before reaching the furnace, to a longitudinal one, recovering the initial crosswise position when they come out.

The chassis or rack 134 embodies ventilators 142, which, if necessary, introduce air from the outside, inside the heat chamber 138 to very quickly modify the temperature conditions inside the furnace.

The lower opening of the furnace, only allows the longitudinal entry of the footwear inside the heat chamber, heating or cooling only the strictly necessary mass. In addition, this longitudinal entry of the shoe allows the heating chamber to have a reduced width, which thus occupies a relatively small volume, so that, to reach a given temperature, a small amount of energy will be needed.

On the other hand, the conveyor unit is at all times outside the furnace, which avoids problems of failures and oxidation of the different components, among which is the electronic memory chip, which carries the information about the operations to be made in the footwear, as we have repeatedly said.

In the figures 33, 34 and 35 we see the structure of the robot for pounding-up the shoe edge, in accordance with the invention. This consists of a metallic structure formed by the base 143 and the four sloping pillars 144, joined at the top, in pairs, by the braces 145 which follow a longitudinal direction to that of the pallets conveyor which solidarily carry the lasts.

The reference 146 designates the rack fixed to the ground, which supports both the pallets conveyor and the pallet locking device, reference number 147, when the hydraulic cylinder 148 is operated, pressing the longitudinal edges of the pallet against the upper flanges 149 of the frame 146, as is deduced when observing figure 33.

In the figure 34 we can clearly see the layout adopted by the pounding-up head which has the general reference number 150 and which is suspended from the conveyor unit 151 which has transverse, longitudinal and vertical movement as we have seen earlier.

The dolly 152 of the conveyor unit 151 moves in a crosswise direction to the movement of the pallets conveyor, guided on bars 153. Reference 154 designates the air-operated cylinder that shifts the dolly 152.

The movement of the head is obtained with the motor 155 and that of the pounding-up head 150 with the electrical motor 156.

In the figure 34 we can see how this head 150 knocks the shoe via the hammers 157. The number of hammers 157 depends on the type of shoe, where a side hammer and another upper one is needed for the lasted, or simply one side hammer and which is made up of a shaft and a loose roller that adapts to the shoe, leaving

the angle of the lasted perfected, as is deduced when observing the detail of figure 34.

The locking device 147 of the pallet works with high precision stopping the conveyor pallet on the chain that has a pad that absorbs all the vibrations that are transmitted by the motor 156 when pounding-up, to avoid failures at any part of the pallet and machine.

Once the pallet is secured on the chain, the side cylinders 158 come into operation which belong to the assembly that secures the footwear, which is fixed and with no variation in movement. The rubber supports, to avoid marking the shoe, are referenced with number 159, may also be of clip type, as we have mentioned earlier.

To adapt the pounding-up head 150 to the shape of the shoe mounted on the last, the conveyor assembly is worked which carries out crosswise, longitudinal and vertical movements, all dampened by cylinders and springs, to adapt fully to the convex and concave curves of the shoe and absorb any irregularity which it may have.

In terms of the type of leather, quality of lasting and customer quality requirement, the hammers can be replaced or complemented with a roller of leather blades, which when rotating, would eliminate any excess creases or else by a roller of rings or similar, crossed by a rotating shaft of smaller diameter, which are displaced by centrifugal force to hit the lasted. These cylindrical hammers have heating with temperature control, so that, with the suitable heat, they can flatten the leather better when hot.

All the machine movements are controlled by a programmed robot, which receives the orders via the chip carried by the lasts.

With special reference to the figure 35, we can see that the zone for pounding-up the shoe 160 on the sole 161 and all this mounted on the last, is referenced as number 162.

Referring now to the numeration adopted in the figures 36, 37 and 38, we can see how the individual pallet for sole conveyor, with locking and stopping system, in accordance with the invention, generally has the reference number 163 and is materialized by the base plate 164 at the bottom of which are the guide mechanisms and immobilization means for the conveyor chain, as can be seen from figure 36. This lower part of the pallet has the reference number 165.

Reference 166 designates the plurality of orifices existing at one of the halves of the base-plate 164, to be able to suitably assembly the unit that contains the sole, as referenced with 167 in figure 36, or referenced with 168 in figure 37.

In the figure 36 we observe how in the left part of the base-plate 164 and following a mean longitudinal line, there is a notch 169 where the sliding part 170 is guided, assisted by the spring 171, which has the orifice 172 for inserting the fixture part 173 (see figure 37).

Figure 37 diagrammatically shows the way that the fixture or total immobilization of a sole 174 will be done, corresponding to one of the highest sizes. The rear of the sole 174 is supported on the "V" shape arms of the

fixture unit 168, located in one of the selected orifices 166. The front part of this sole 174 also rests on the arms of the fixture part 173, from pressure exercised by the spring 171.

In the example of embodiment shown in the figure 36, the sole 174, corresponding to one of the smallest sizes, is perfectly immobilized against the projections 175 and 176 of the contiguous edges of the base-plate 164, which can be prolonged in the dismountable flap 177; this immobilization is achieved by the pressure exercised by the fixture unit 167 whose structure and functionality we are going to be described below.

This fixture unit 167 is materialized by the laminar part 178 which generally has a triangular contour, oscillating at one of its vertex, around the screw-shaft 179 that passes through one of the orifices 166 of the base-plate 164. At the most distant vertex is the pin 180 to provoke the angular deviation against the spring 181 which assists the screw-shaft 179 and this laminar part 178 to achieve side pressure on the sole 174, through the cam 182 of notched section 183. Cam 182 is interchangeable and can be fixed at different angular positions, depending on which orifice 184 foreseen in their periphery, are selected for passing the pertinent immobilization screws to the laminar part 178.

With special reference now to figure 38, we can see the individual pallet 163 for sole conveyor, arranged on the conveyor chain. Immobilization is reached when the fixture piston 185 is enabled, coupled to one of the "U"-shape branches of the fixture or stopping position, located in the action zone of the robot which has to submit the sole 174 to one of the work operations described above. The "U" support is referenced as number 186 and is anchored to the upper end of the pillar 187, whose base 188 is secured to the floor.

With this layout we can see how the advantages according to the invention are reached, because pallet 163 is specially designed to lock soles 174 of any size number, simply changing the position of the fixture system 167, or else, the 168, in respect of one of the orifices 166 of the pallet, which operation is done very quickly and simply.

We can also see how different models of soles can be easily changed in the same pallet 163 (ranging from plain to bandalet for sports shoes), by just changing the fixture system and coupling the pertinent accessories.

All the fixture systems of sole that are used can vary easily and quickly put and remove the sole, and also have a decimal precision in fitting one and the other, so that the robot can carry out its programme repetitively and independently between the different pallets.

The different types of jobs that are being processed at the automated chain can be carried out on pallet 163, such as: cementing of the sole in its different forms, for example using gun, brush or spray; halogenating of the sole; surface modification system of the material (by laser or other similar techniques) instead of halogenating or roughing for better cementing; or the artificial vision

system to convey the characteristics of the sole to the computer.

When some job is going to be carried out on the sole, by a robot, the pallet is locked by a fixture post, or stopping, which leaves it in a suitable place with decimal precision, for programmes to be repetitive and the robot to have its "zero" setting fixed.

The materials with which the pallets have been made have been minutely selected to perfectly withstand the movements and temperature changes of the production line and comply perfectly with their work.

By means of the fixture units 167 and 168 and their interchangeable accessories, and also the springs which push them, the sole 174 is perfectly aligned in the suitable position, depending on the model that is used.

When cementing using gun, dismountable side walls 189 are coupled to the pallet 163 to prevent any surplus cement from emerging, as shown in the figure 37. These side walls 189 are fixed in the peripheral orifices 190 foreseen for this purpose in the base-plate 164 (see figure 36).

Lastly, in figures 39 to 46 we can see the structure of the footwear uppers reactivator that forms part of the plant where this automated footwear manufacturing process is carried out. It includes a load and control unit by artificial vision, which has the general reference number 191, and also another conveying unit with the reference number 192, where in the first the reactivating is moreover started, which later continues in this second unit.

Reference 193 designates the pallets which are accessed with the footwear uppers 194, that are displaced by the cylinder 195 towards the conveyance post 196 to the loading post 191; this action is carried out by another cylinder 197 which provokes the rotary motion 90° around the vertical shaft 189.

In the figure 42 we can see how the upper 194, upon entering the reactivator, is held on the outside, between forks 199, and also by the front clip 200 which is arranged in a mid-way setting between the video camera 201 and the lighting device 202. This video camera 201, with The light emitter device 202, define the artificial vision system which distinguishes the type of shoe and characteristics inherent in it, as described above.

The pallet which supports the stack of uppers 194 inside the loading station 191, has reference number 203 and when this is full it goes on to the conveyor and reactivating unit 192 where water steam enters via sprinklers 204. When this conveyor unit is complete, the storage dolly 205 is detached, where up to two hundred pairs can be kept at suitable temperature for lasted, and can also be conveyed comfortably and quickly to the utility station, which lies next to the machines for mounting crowns, heels and shanks.

In the figure 43 we see a sequence of movements that correspond with the three identification and recognition phases by the video camera 201, of the upper 194 which must be received inside the loading unit 191. In the phase a) the reader, with the video camera 201

detects the type of shoe that corresponds to the upper 194; when accepting it as correct, the fork 206 is placed over the upper 194 and does not allow it to come out (when it is not valid, this operation is not done), as shown in phase d); and lastly, in the third phase c), the cover 207 of the loading station is removed and the upper 194 is inserted inside the reactivator.

With special reference now to figure 44, we can see how the front part of upper 194 embodies in its peripheral edge, the notches that correspond to identification marks of the characteristics of the upper 194, such as those referenced as 208, which correspond to marks for calculating symmetry shaft, marks 209 of the numbers, marks 210 of reference, marks 211 that indicate the foot (left or right), marks 212 to determine the model, etc. With all these marks, a genuine language is created to convey numerous variables that are read and interpreted in binary code by the computer.

In the figure 45 each of the self-adhesive paper strips have been referenced as number 213, which are given to the clicker to stick on the clicking knife 214 (see figure 46), also facilitating the marking on this knife of any variances which will be determined by marks 208 to 212 of the edge of the upper of the footwear 194. On each of these self-adhesive paper strips 213 the codes of the size number 215; foot code (right or left) 216; model code 217, etc. are defined between reference points. In this code label example given in figure 45, the code corresponding to the shoe model is kept invariable at the foot, only changing the binary code which identifies the size number 215.

Based on the different elements described in the present descriptive report, it is possible to design mini modular plants to adapt their configuration to small footwear productions.

In this way, based on a single module formed by a conveyor chain and six operators who complete the production process, we can gradually add more modules to form a pre-installation of the type described in the invention.

These modular plants designed for small productions will preferably be formed by different, more economic tables, instead of robots, to carry out the roughing, cementing operations etc., although any system described in the present invention could be adapted and automated or optimize the different work steps.

With this functional versatility, the enormous advantages offered by the plant and process described in the present invention can reach the small manufacturer.

## Claims

1. **AUTOMATED FOOTWEAR MANUFACTURING PROCESS**, using two independent pallets conveyor chains, one for the lasts and the other for the soles, giving full independence to the handling of the soles and the upper of the lasted footwear on the lasts, characterized because this consists of the following steps: firstly, the last that contains information inside,

informs about the model, right and left foot and number, which is going to reach the robot (27) which will fit the respective insole on the last; it continues to advance on the conveyor belt of pallets (23) until the next stop where an operator proceeds to shoe or assemble the crowns, heels and shanks; the shoe lasted on the pallets belt rotates 90° to be introduced in a tunnel furnace (31); another operator supplies a similar second conveyor chain (24), with in-soles, uppers and plants, according to the information which is supplied by a computer; when a certain number of loaded pallets are ready, the uppers reactivator to the laster of crowns, heels and shanks is then changed, and the insoles feeder to the inner soles robot (27); the lasts rotate when leaving the furnace (31) in a reverse direction, entering in zone of the robot (33) in charge of pounding-up the shoe; the last continues to the robot (34) which makes the heel seat if so required, roughing the lasted with the robot (35) and the side, moving until the stopping position of the six shaft robot (36) that applies cement to the shoe and pre-cementing when necessary, and also to the sole carried on its respective chain (24), because there is a loop and crossing at this point in the transport lines; later both the last with the shoe, and the sole are unlocked, proceeding towards the conventional driers (38) for drying and reactivating by flash; the chains (23, 24) again cross to allow a third operator to join sole and shoe, continuing on the last to be submitted to a pressing process that lasts several seconds by solid union of the upper with the sole; the last again rotates 90° to enter a cold conditioner tunnel (40), from which it comes out automatically towards the robot (41) which extracts the shoe from the last as final step.

2. **AUTOMATED FOOTWEAR MANUFACTURING PLANT**, of the type that use a conveyor belt in continuous cycle which transfers the footwear pieces using the different handling steps: cementing, drying, injecting of soles, pressing, etc.; characterized because the last is locked on it on the inside of the individual pallet on which the lasts are conveyed and information about the last is sent to the robot, also inside the pallet, each pallet incorporating an electronic memory chip in which the operations which the footwear placed in the last are to undergo, are programmed, allowing shoes of extremely tall heights to be made; an insole-fitting robot has been foreseen, integrated and communicated in the same footwear production line, which is arranged on the respective lasts of the conveyor chain; and where an automatic machine intervenes to cement footwear soles, this being of the type that are formed from a metallic structure with a platform or table that supports the footwear, and where a cementing chamber has also been foreseen, with an elastic membrane that pushes the sole through compressed air throughout its area during the process of cementing

it on the respective footwear; incorporating a lasting furnace or stabilizing of footwear whose heating chamber can be set at a desired value depending on the type of footwear; also integrated in the automatic manufacturing line that conveys the shoes, linearly, already inserted in the lasts solidary to the respective pallet, there is a robot for pounding-up the shoe edge, which operates in a programmed way when it receives information about the type of shoe which it has to pound-up, giving the suitable pressure and fit, without the intervention of manual labour, all movements of the machine being controlled by a programmed robot, receiving orders from the chip carried in the lasts; the individual pallets for conveying the soles incorporate a locking and stopping system, which make them pass through each of the robots, where some operation or job has to be performed on the sole (cementing, halogenating, surface treatment by laser, roughing, control system by artificial vision for transmitting characteristics to the computer, etc.); where a footwear uppers reactor has also been foreseen, also integrated in the automatic manufacturing line and where each type of upper and its orderly storage is identified, depending on how the computer that controls it has been programmed; also characterized because it includes:

a) Two pallets conveyor bands (23, 24) with continuous closed cycles: one as conveyor chain of lasts (23) and the other for conveying soles or bottoms (24), having the peculiarity that the conveyor chain of lasts (23) crosses over the chain of soles (24) and is intersected at certain points depending on the needs or design of the plant; where it has furthermore been foreseen that both the conveyor chain of lasts (23) and that of the soles (24), present extensions in certain sections in the form of loops which confer greater versatility and allow the size to be adjusted to the drying or waiting times, and also to allow a same robot to carry out different operations; at the conveyor points or sectors where the chains have to go through drying tunnels, there are also furnaces, reactivators, etc., systems that produce a rotary motion of 90° on the pallet (25) that conveys the last (68) with the upper of the footwear so that this enters lengthwise and not transversely in them, allowing the section of the furnace to be reduced;

b) Individual pallets (25) for conveying lasts, each of which is formed by a rigid structure defined by a main section (66) with an upper guide (70) for the connection of the last (68) by means of a turret (67), and another guide for the information terminal (82), and also the lasters (87) and notches (88) for stopping the pallet, depending on the position in which it lies where it has been foreseen that the connection of the

last, made by means of the part or turret (67) secured by screws to this last (68), is carried out when this last is plugged into the guide (70) of the pallet, where an automatic auxiliary fixture system has been foreseen for this turret-pallet connection, and also a locking/ unlocking motion of the last-pallet connection;

c) An insole-fitting robot consisting of a round feeder (95), where all the inner soles (96) that are needed are classified in different stacks, depending on the number and type of last that has been conveyed to it by means of chips, where there is a head (97) that absorbs the insole (96) that is selected and conveyed to the last, passing previously via certain cement multiple injection nozzles (100), that are adjustable in height to vary the field of application of the cement on the insole (96), leaving the head (97) on the insole (96) centered and a very short distance away from the last, with the help of laster plates defined by positioning clips (101) that finally descend so that the cementing can be performed on the footwear, where it has also been foreseen that a loader or air-operated finger (102) unlocks the last of the pallet so that the operator who makes the lasted can separate it easily from the pallet;

d) An automatic machine for cementing soles of footwear, consisting of a quadrangular base (105), from whose vertexes each pillar emerges upwards (107), which are joined at their free ends to an upper bridge (108) to which a rotating nut is coupled (124) where a vertical spindle (122) is screwed, whose bottommost end is connected to the cementing chamber (109) by means of a pin (127), where the said nut (124) counts on a gear ring (125) where a chain (126) is connected, coupled to a motor (123) to make the nut (124) rotate, so that the cementing chamber (109) moves vertically; where it has been foreseen that the platform or table (106) is divided into two parts, and at the same time counts on two pairs of legs or arms (110), each of which is associated by an air-operated cylinder (111) that separates both parts of the table (106) when this corresponds, where the bottommost ends of the said arms (110) are articulately coupled on two supports (112) by means of pins (113), and at the same time to each of these supports (112) a vertical spindle (114) is attached, screwed on a rotary nut (115) bound to the quadrangular base (105); fixed to this nut (115) there is a gear ring (116) which rotates by means of a reducing motor (119) with electrical brake, where the movement is conveyed via a chain (117); all this in order to allow the vertical displacement of the two supports (112) and other elements related with them;

e) A lasting furnace or stabilizing of footwear, fixed to the upper part of a rack (134) determined by various vertical pillars (135) and other horizontal transverse ones (136), where coupled to this rack there are ventilators (142) capable of introducing air in the heating chamber (138) of the actual furnace (137); where it has been foreseen that this communicates with the exterior via a narrow bottom opening (139) protected by a curtain (140), so that the conveyor chain that forms part of the manufacturing line, passes beneath the furnace (137), where engaged to this chain are the pallets that carry the lasts with the footwear, which is introduced lengthwise into the heating chamber (138) thanks to the narrow bottom opening (139); where a system has also been designed to disengage the pallets from the conveyor chain when this corresponds; with the peculiarity that in the entry zone of the furnace and at the outlet zone, rotary stations of the pallets have been foreseen to carry out a 90° rotation from their transverse position, recovering the longitudinal position at the outlet of the furnace;

f) A robot for pounding-up the shoe edge, which consists of a metallic structure defined by a base (143) that can be fixed to the ground or supported on rubber-blocks, and four oblique pillars (144) that are placed in twos on each side of the conveyor of the pallets of lasts, being joined up the top by two cross rods (153) spread between two longitudinal ties (145), where these cross rods (153) materialize the slip guides of a conveyor assembly (151) formed by a rotary head driven by a motor (155) lasted on a movable dolly (152) on the guides, (151) by a side operated cylinder (154), from which a pounding-up head hangs (150) which hits the edge of the lasted arranged on the last (68), following its entire contour; where the pallet is locked at the stopping station opposite the robot, commanded by a sensor, and where a footwear fixture assembly is enabled (158, 159) which prior to the pounding-up secures it, completing the cycle when the pounding-up head (150) returns to its initial position to allow the pallet to come out and wait for the next one;

g) An individual pallet to convey soles, with locking and stopping system, integrated in the line or conveyor chain, determined by a base plate (164) fitted at the bottom with guide systems and immobilization in respect of the conveyor chain at the stopping or work stations, by means of the pertinent fixture position (186) of the pallet (163), with decimal precision, and on which the sole is fitted (174) that is suitably anchored with a system that secures the sole (167, 168-173), that can be interchanged, that allows the locking of any size number, foot (left or right) and model

(plain and even with bandelet for sports shoes, etc.);

h) A footwear uppers reactivator, where at its entry the uppers (194) that access via the conveyor chain of pallets, are individually secured by a pallet system (199, 200) at the rear and by a special clip (200) at the front end, the latter controlling the thickness of the leather; where at the top of this front zone of the upper (194) there is a video camera (201) and at the bottom a lighting system (202) to identify both the size number, foot and model, and the colour of the leather of the footwear, where it has been foreseen that if the computer approves the information of characteristics received, the upper (194) is assimilated towards the inside of the load station (191) where it is stored in an orderly manner, reactivating the uppers (194) in it by steam or heat depending on the type of leather and other characteristics.

### 3. AUTOMATED FOOTWEAR MANUFACTURING PLANT, in accordance with claim 2, where the 90° rotary system for the pallet (25) that advances on the belt (23), is determined by an approximation detector that commands the elevation of a fixed side stub (60) which is inserted on the guide of one of the corners of the pallet (25), where this rotary motion is provoked when the belt advances, after which this stub descends (60).

### 4. AUTOMATED FOOTWEAR MANUFACTURING PLANT, in accordance with claim 2, where the conveyor chain (23) presents a stopping and locking motion of the pallet (25), at the points where work is carried out on the shoe, materialized by a cylinder (62) that raises certain arms (63) whose ends are embedded in guides of the pallet, immobilizing it against fixed upper wings (64) of the work station, losing contact with the conveyor belt or band (23).

### 5. AUTOMATED FOOTWEAR MANUFACTURING PLANT, in accordance with claim 2, where the connection and fixture system of the turret (67) to the pallet (25, 66), is determined by a front cog (73) and bottom cog to the turret (67) assisted by a spring loader located on a staged transverse orifice (74), that materializes the automatic auxiliary fixture system, centered on an orifice (75) facing the bushing (71).

### 6. AUTOMATED FOOTWEAR MANUFACTURING PLANT, in accordance with claim 2, where the locking/unlocking motion of the connection of the turret (67) to the pallet (66) is determined by a rod (76) that crosses the pallet (66) lengthwise and vertically, enabled by means of a bottom loader (77) to be raised against a contrasting spring (79), so that its internal upper end interrupts in the receiver guide (70)

of the turret (67) and is inserted behind its rear notch, preventing side displacement.

7. **AUTOMATED FOOTWEAR MANUFACTURING PLANT**, in accordance with claim 2, where the information terminal, defined by an electronic memory chip (80), is incorporated at the bottommost base of the turret (67), in a guide (81) designed for this purpose, where the base of the guide (70) contains a part that carries the connector (82) assisted by a spring, where the cable (83) to transmit the information passes via an endlong orifice to the pallet until its base, to end in an information terminal (85), where there is a reader (86) that transmits the information to the robot which has to handle the footwear at the work station at which the pallet has stopped.
8. **AUTOMATED FOOTWEAR MANUFACTURING PLANT**, in accordance with claim 2, where the pallet (25) incorporates in its main section (66), a hollow shaft (91), that is slightly tapered and emerges from this main section (66), as locking device of the turret or connecting part (90) with the last (68), because it is contained in a conduit (92), that is also tapered, of the turret (90), where the last (68) is firmly secured to the turret (90); where an unlocking rod (93) has been foreseen of the last (68) that crosses the entire pallet and hollow shaft (91), making an upward end-long movement to unlock the last (68) which is commanded by the stopping system of the manufacturing line.
9. **AUTOMATED FOOTWEAR MANUFACTURING PLANT**, in accordance with claim 2, where the feeder (95) of inner soles (96) is rotary and trips when it receives the orders from the last (68) which accedes to the robot position to select the type of insole (96) that is needed, including a pallets carrier and pallets (103) that are easy to change, which incorporate tubes (104) that carry high power magnets on their bases, to define magnetic guide setting pillars and adjustment of the stacked inner soles (96), according to the geometric form which they present.
10. **AUTOMATED FOOTWEAR MANUFACTURING PLANT**, in accordance with claim 2, where the fixture assembly of the footwear (158, 159) is defined by two side cylinders (158) anchored to cross members of the metallic structure (144), which drive two arms in a longitudinal direction to the shoe, that are finished off on rubber supports or clips (159) to avoid marking the shoe, depending on the type of shoe for pounding-up.
11. **AUTOMATED FOOTWEAR MANUFACTURING PLANT**, in accordance with claim 2, where the conveyor unit (151) of the robot for pounding-up the shoe edge, has a transverse, longitudinal and vertical movement, with cylinders, shock absorbers and springs to adapt to the concave and convex curves of the shoe and absorb any irregularity in it.
12. **AUTOMATED FOOTWEAR MANUFACTURING PLANT**, in accordance with claim 2, where the pounding-up head (150) hits the footwear by means of one or two hammers (157) depending on the type of shoe, one being a side hammer and the other at the top for the lasted, or simply a side one, formed by a shaft and a free roller that adapts to the shoe, improving the angle of the lasted, where it has been foreseen that in terms of the type of leather and other parameters, this is completed with a roller of leather blades which, upon rotating, eliminates any surplus creases, or else, with a roller of rings crossed by a rotary shaft and having a smaller diameter which are moved by centrifugal force, hitting the lasted; where these cylindrical hammers (157) may embody heating with temperature control.
13. **AUTOMATED FOOTWEAR MANUFACTURING PLANT**, in accordance with claim 2, where the fixture position (186) of the individual pallet for conveying the sole is defined by a column (187) secured at its base (188) to the ground, beneath the conveyor chain, finished at the top in a "U" support (186) where the pallets (163) move between its branches and where one of them has a side fixture piston (185) of the base-plate (164).
14. **AUTOMATED FOOTWEAR MANUFACTURING PLANT**, in accordance with claim 2, where the base plate (164) of the individual pallet for sole conveyor includes at the top a number of orifices (166) at an end part of its rectangular plant and at least one middle longitudinal notch (169) at the other end, for the parts's guidance system of a part or accessory (170, 173) that materializes the front fixture system of the sole (174) because it has two "U" arms, and where the guide part (170) is assisted by a spring (171), where it has been foreseen that the other end of the sole (174) establishes a support on another part (168) similar to the previous one (173) and located on one of the orifices (166) of the base-plate (164), selected in accordance with the size.
15. **AUTOMATED FOOTWEAR MANUFACTURING PLANT**, in accordance with claim 2, where the base-plate (164) includes a projection (175) in at least one of the angles of its portion that contains orifices (166), against which the sole (174) is applied pressed by a clip (167) assisted by a torsion spring (181), located at one of the orifices (166) by means of a screw-shaft (179) around which it can rotate driven by the spring (181), where this part (167) has a vamp or action control (180) at the other end, where pressure is established on the sole (174) by

means of a cam (182) of grooved section (183), which is exchangeable and orientable.

**16. AUTOMATED FOOTWEAR MANUFACTURING PLANT**, in accordance with claim 15, where the periphery of the base-plate (164), includes orifices (190) to hold flaps (177) or side walls (189) that can be dismounted, which are useful in the cementing phase of the sole (174).

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**17. AUTOMATED FOOTWEAR MANUFACTURING PLANT**, in accordance with claim 2, where the first pallet (203) of the loading and inspection station (191) of the footwear uppers reactivator, is completed with a number of uppers (194) stacked in pallets and is deviated to a storage and reactivation dolly (205) which keeps them at the optimum temperature and which transfers them to the utility station, where they will be lasted.

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**18. AUTOMATED FOOTWEAR MANUFACTURING PLANT**, in accordance with claim 2, where the front edge of the upper (194) contains samples (208 to 212) of information in binary code to the artificial vision system (201-202), of the footwear uppers reactivator, in both size number, and foot and model of shoe, where notches are performed in the same clicking knives used by the manufacturer, when making slight notches on their section.

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**19. AUTOMATED FOOTWEAR MANUFACTURING PLANT**, in accordance with claim 2, where the video camera (201) of the footwear uppers reactivator, forms part of the notch code reader system (208 to 212), transmits the data to the computer and when the upper (194) is accepted, an rear fork (206) is placed over the upper (194) preventing it from coming out, at the same time as the cover (207) of the loading station (191) is removed and the upper (194) is introduced inside the reactivator .

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**20. AUTOMATED FOOTWEAR MANUFACTURING PLANT**, in accordance with claim 18, where the binary code that gives information about the characteristics of the upper (194), is printed on strips of self-adhesive paper (213) which the clicking machine acquires on the outer face of the sheet that materializes the blade (214) of the clicker and which is later transferred to the cutter edge so that the uppers (194) include the notches (208 to 212) for information to the reader system (201-202).

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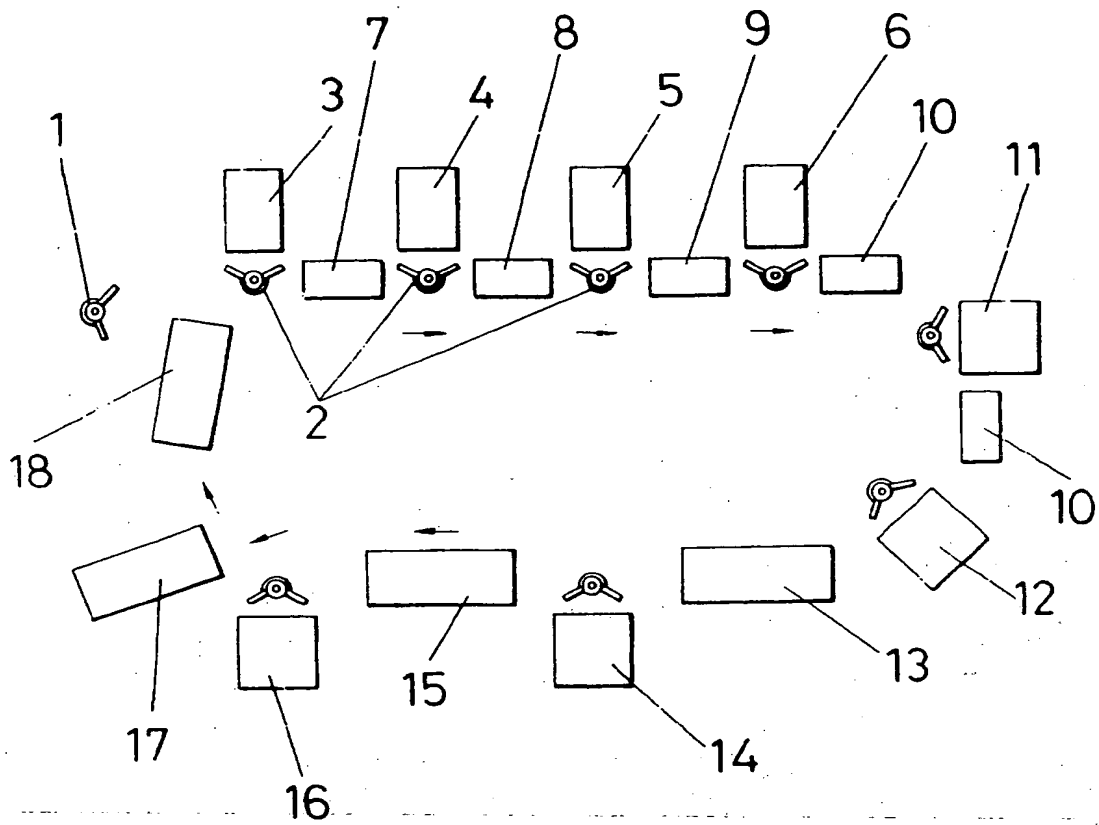


FIG.1

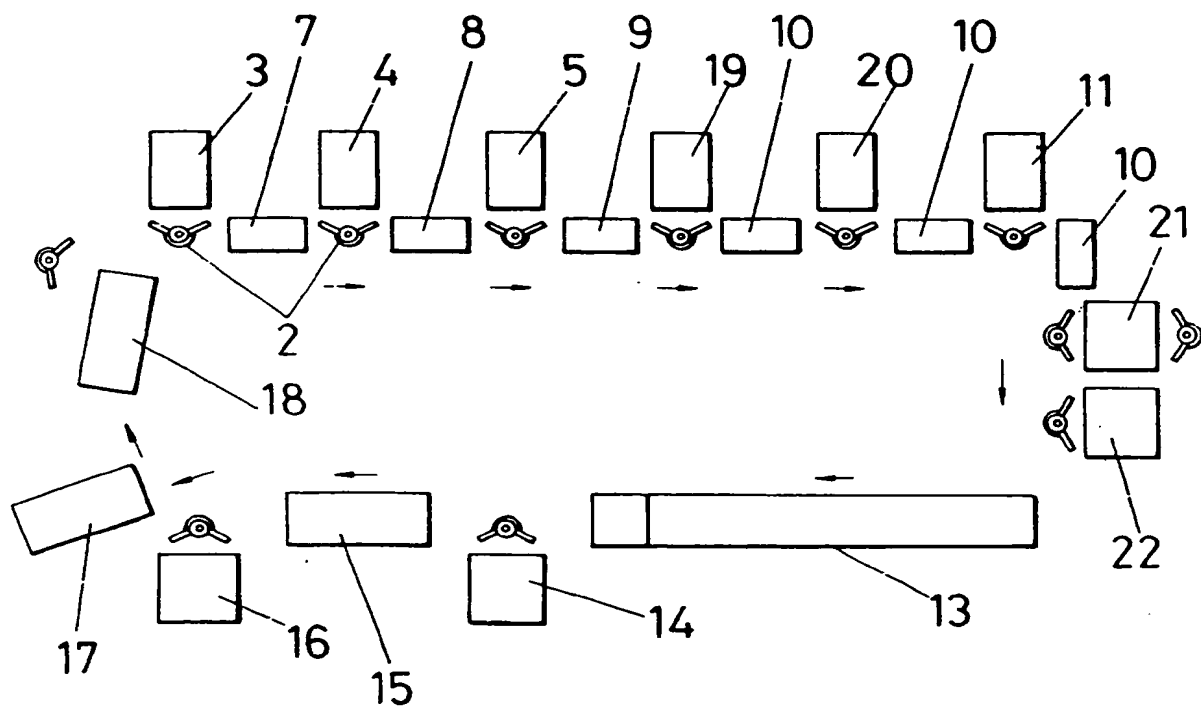


FIG. 2

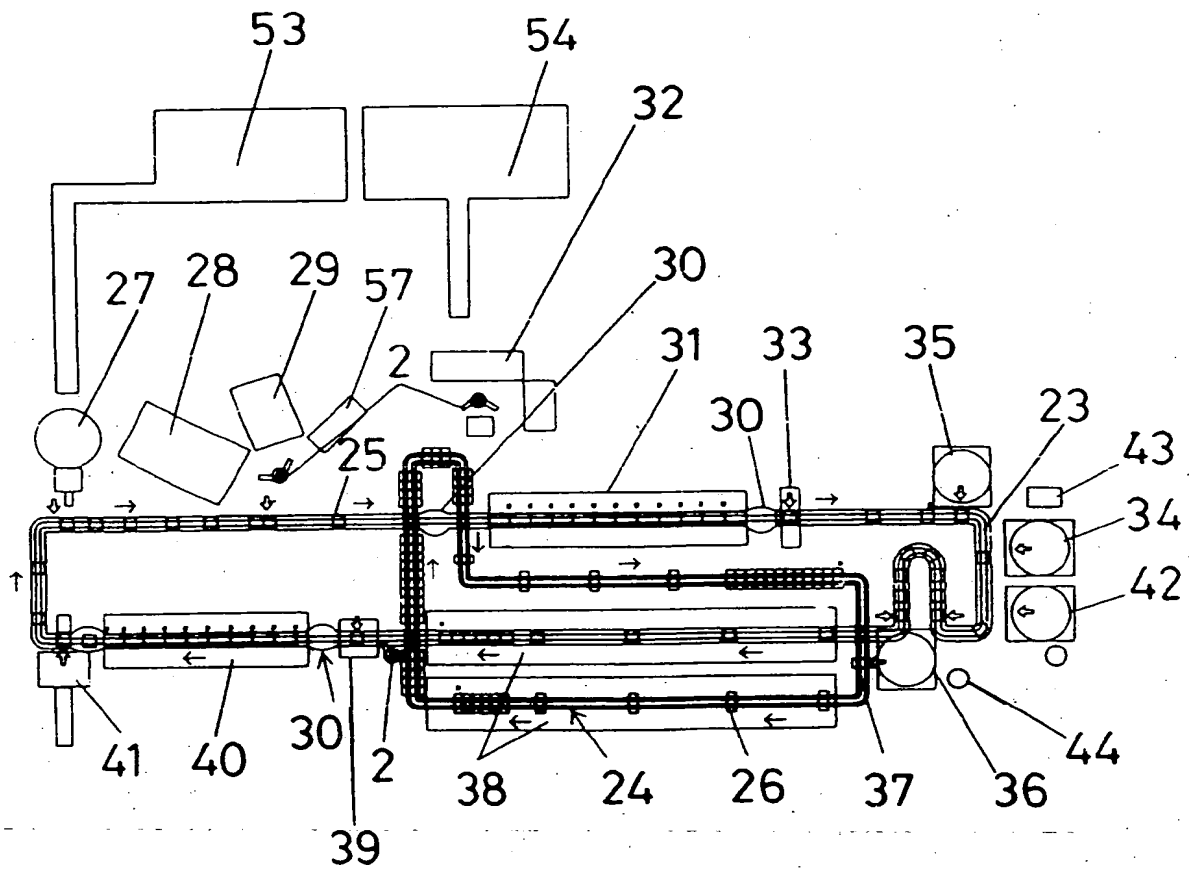


FIG.3

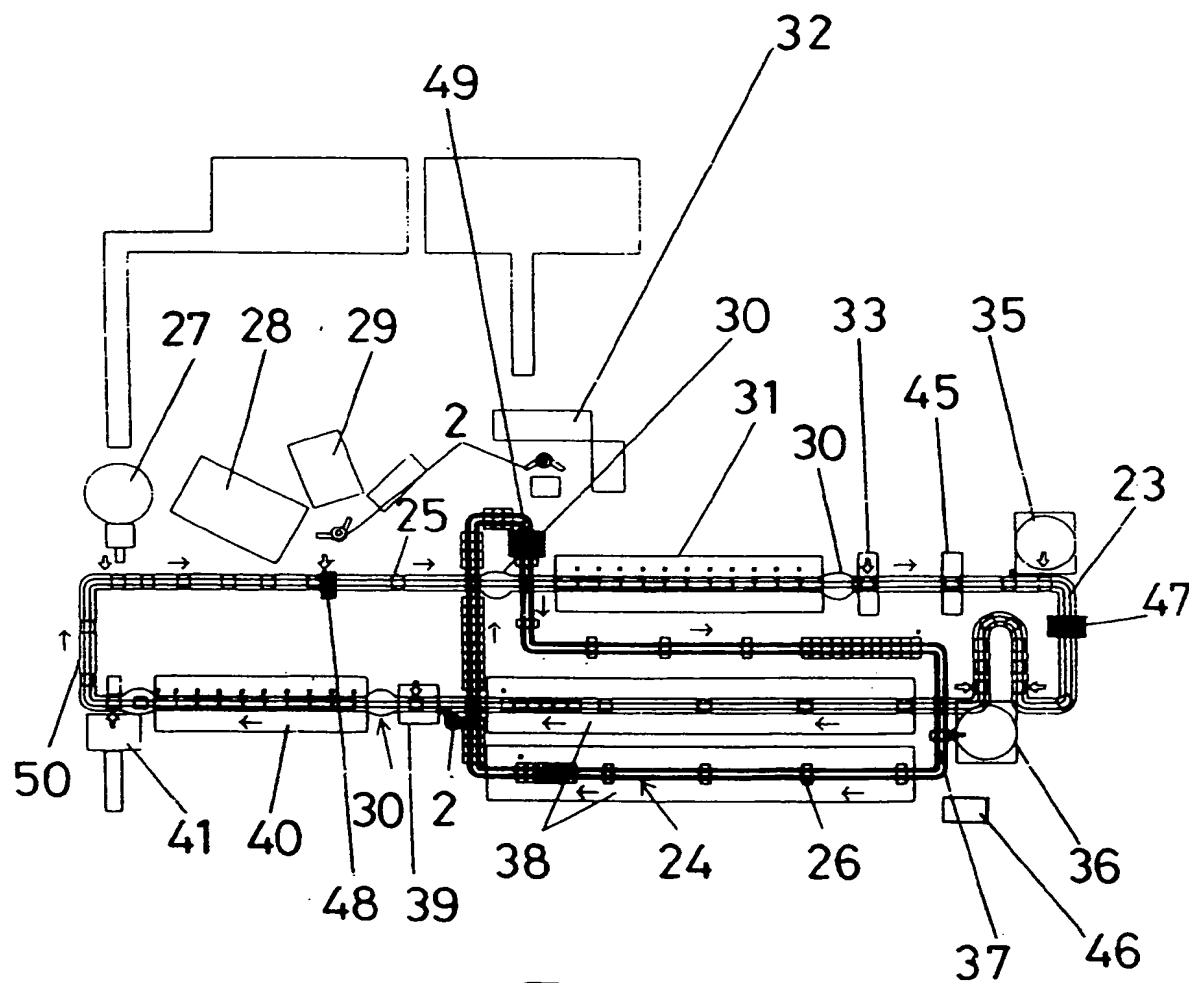


FIG. 4

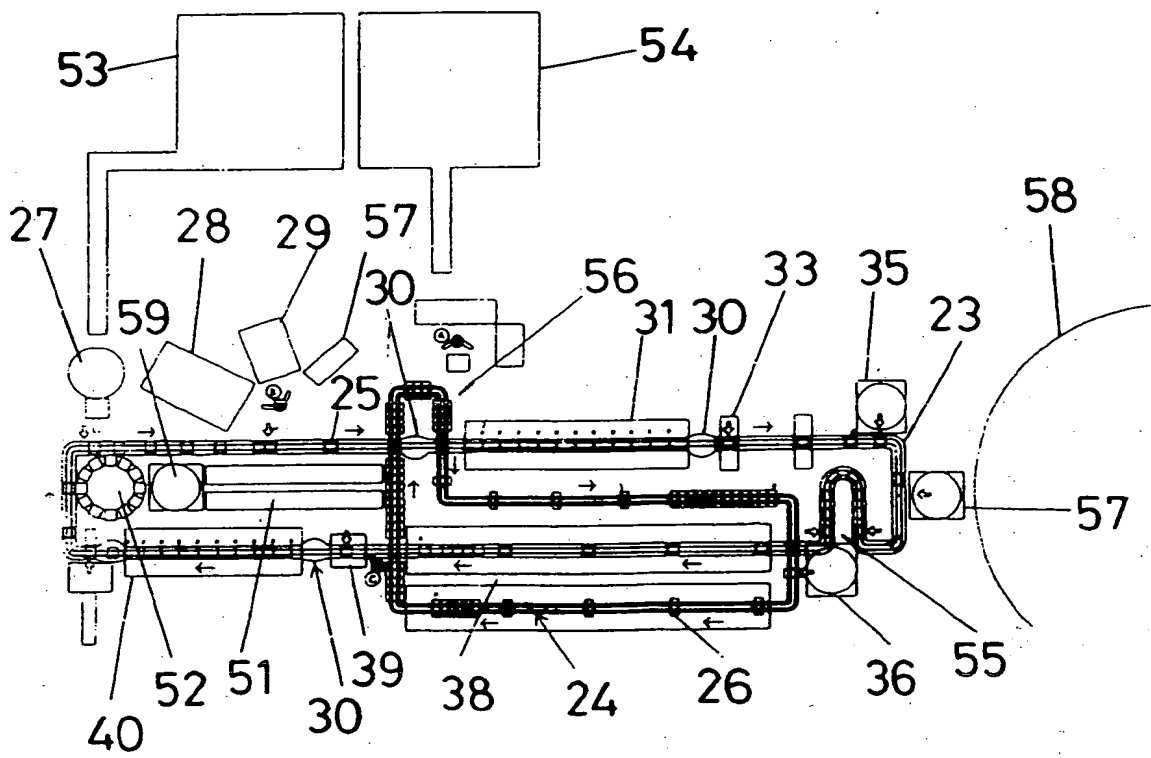


FIG. 5

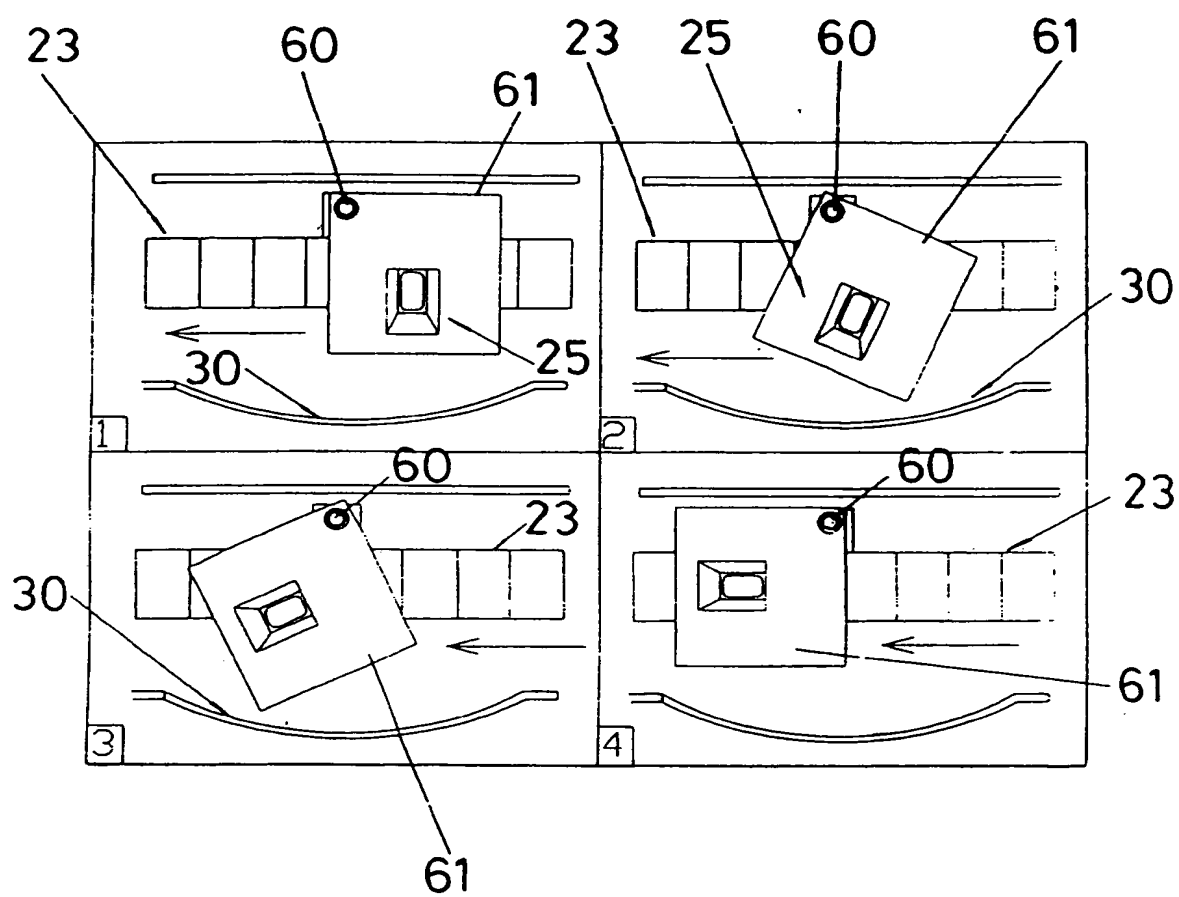


FIG. 6

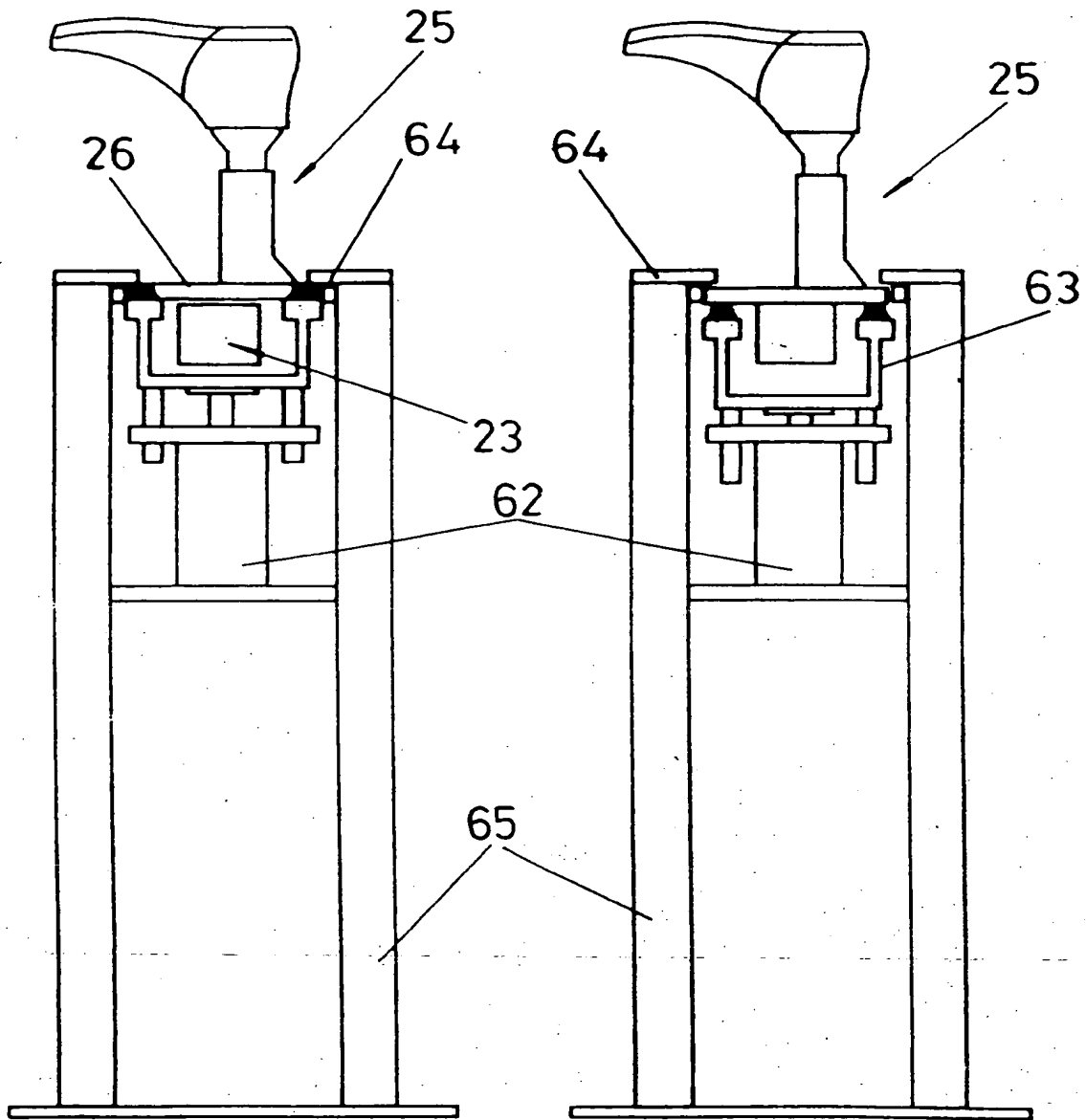


FIG. 7

FIG. 8

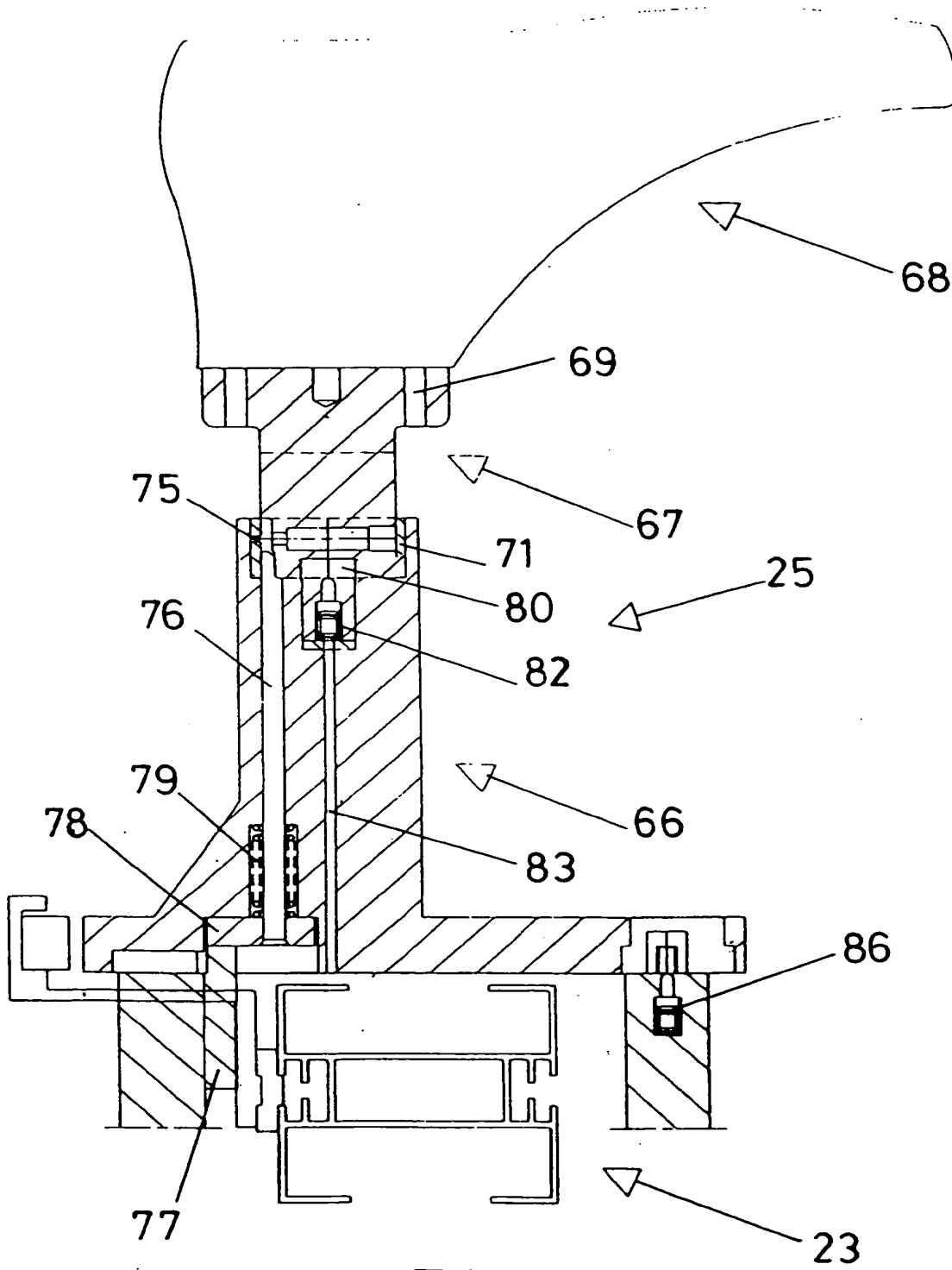


FIG.12

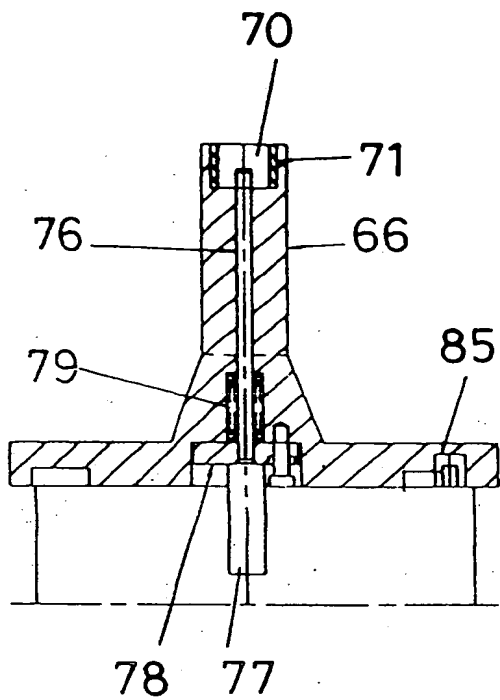
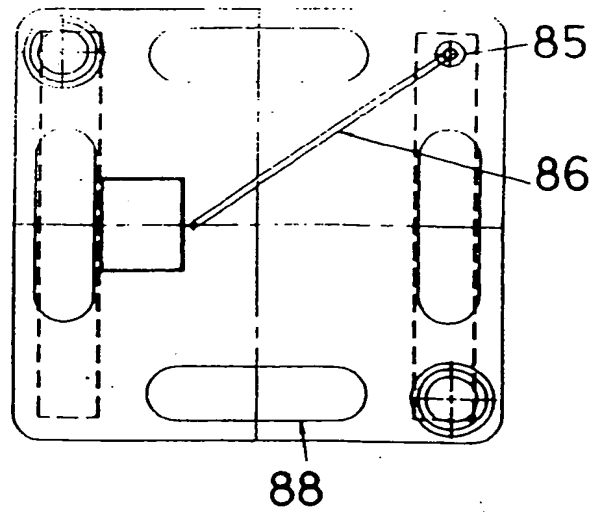


FIG.11

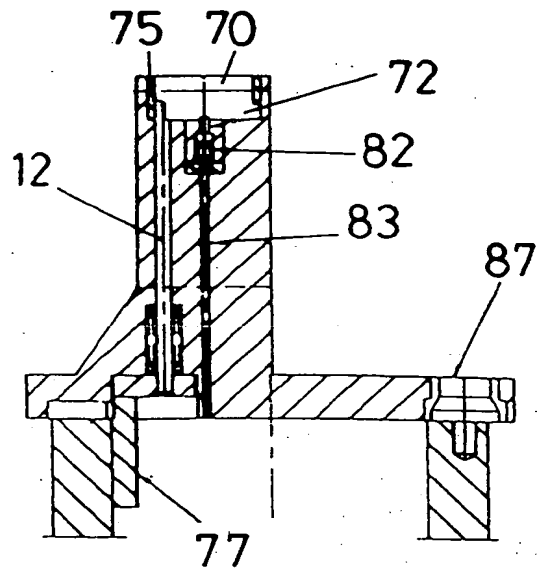


FIG.10

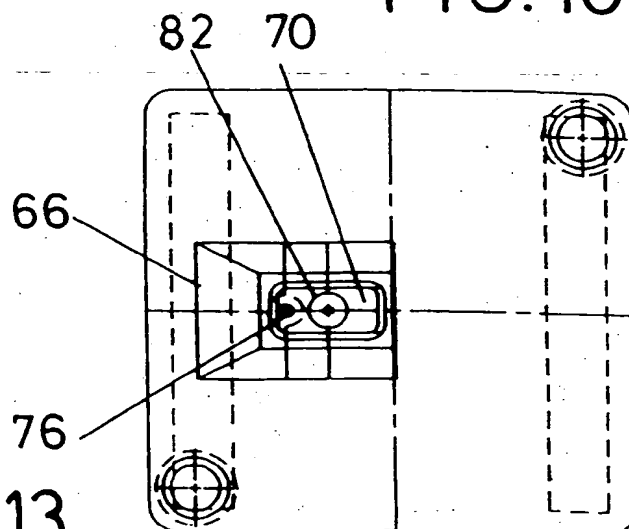


FIG.13

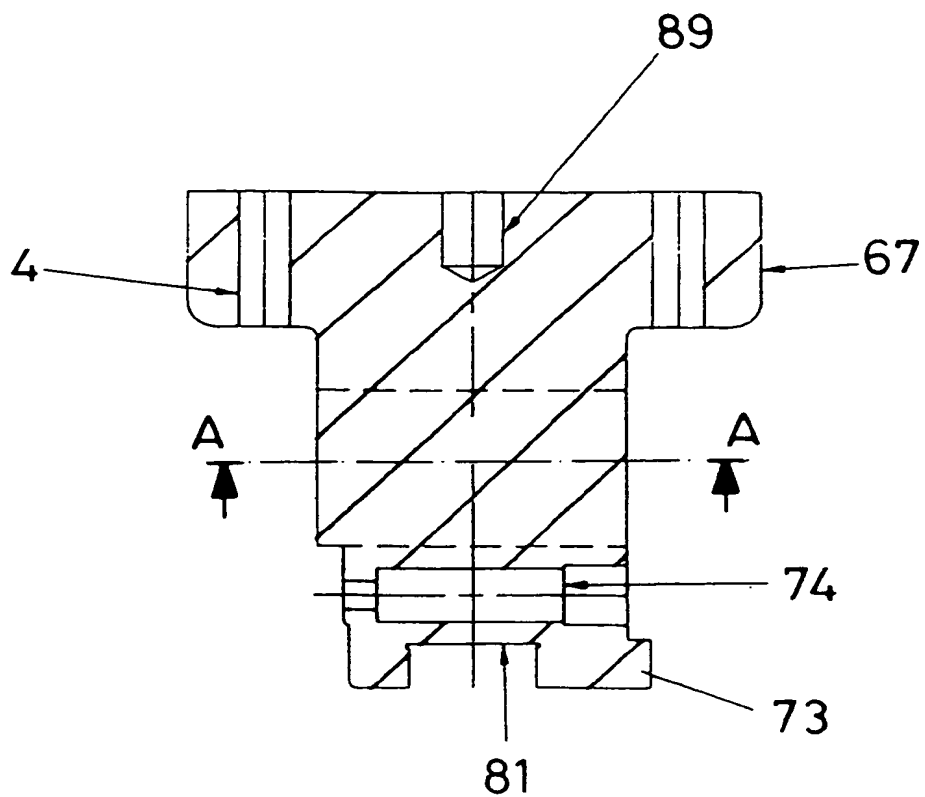


FIG. 14

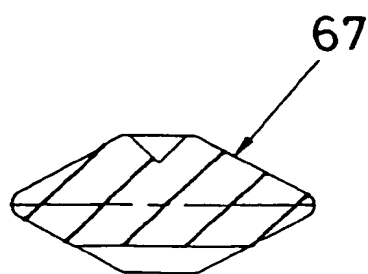
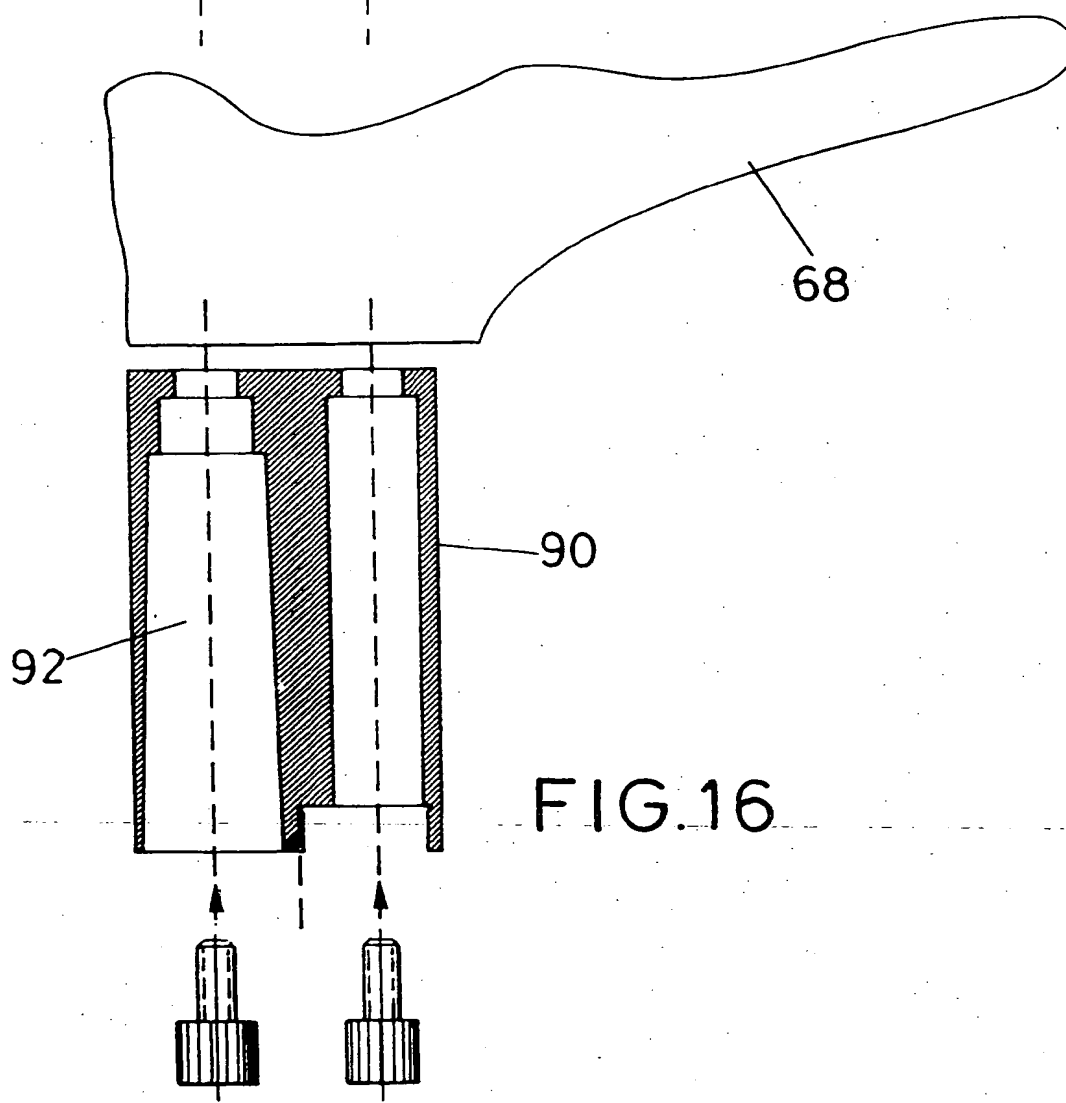
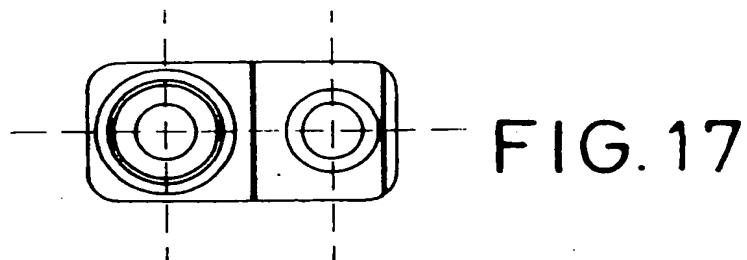
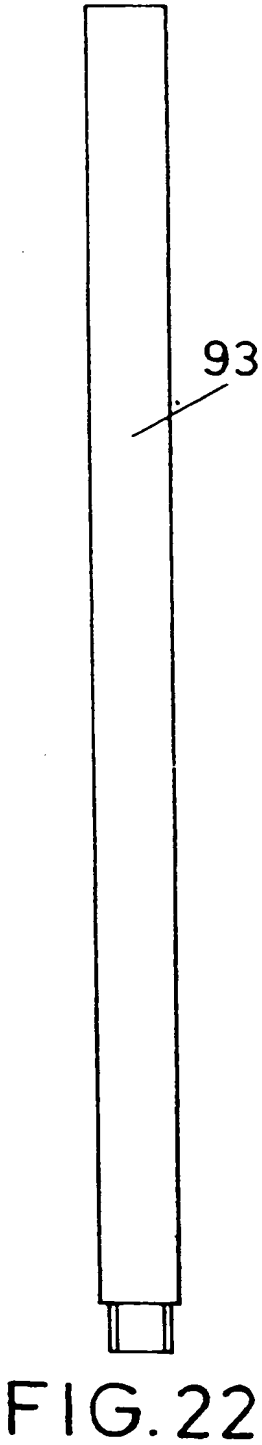
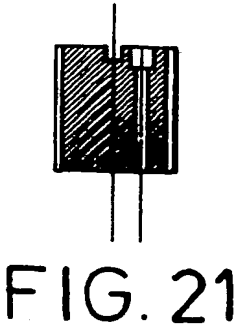
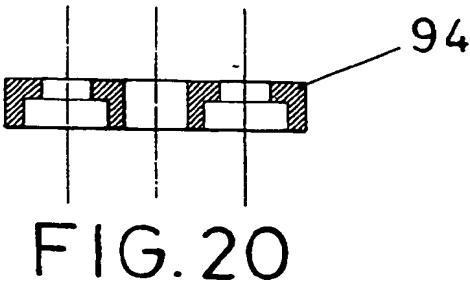
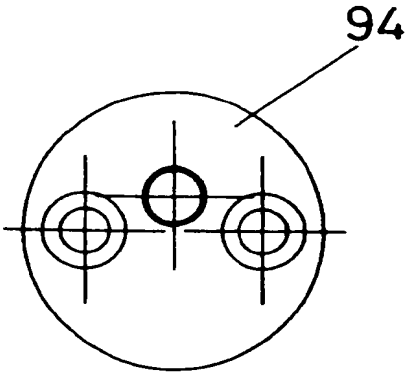
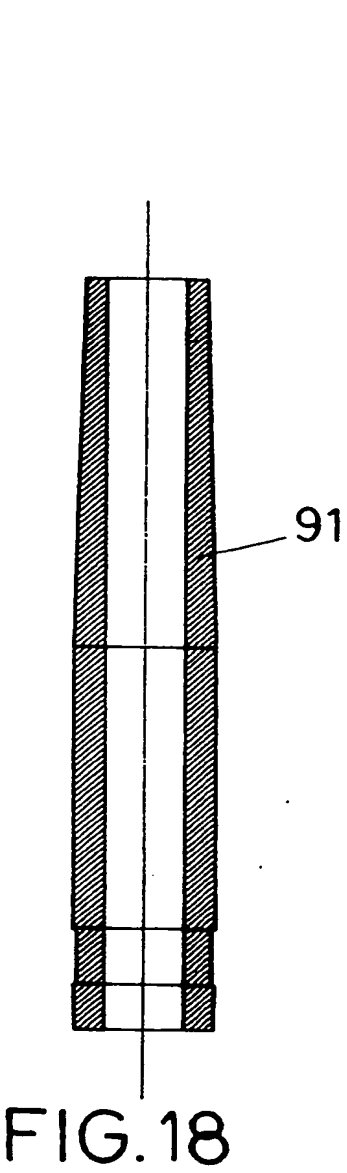
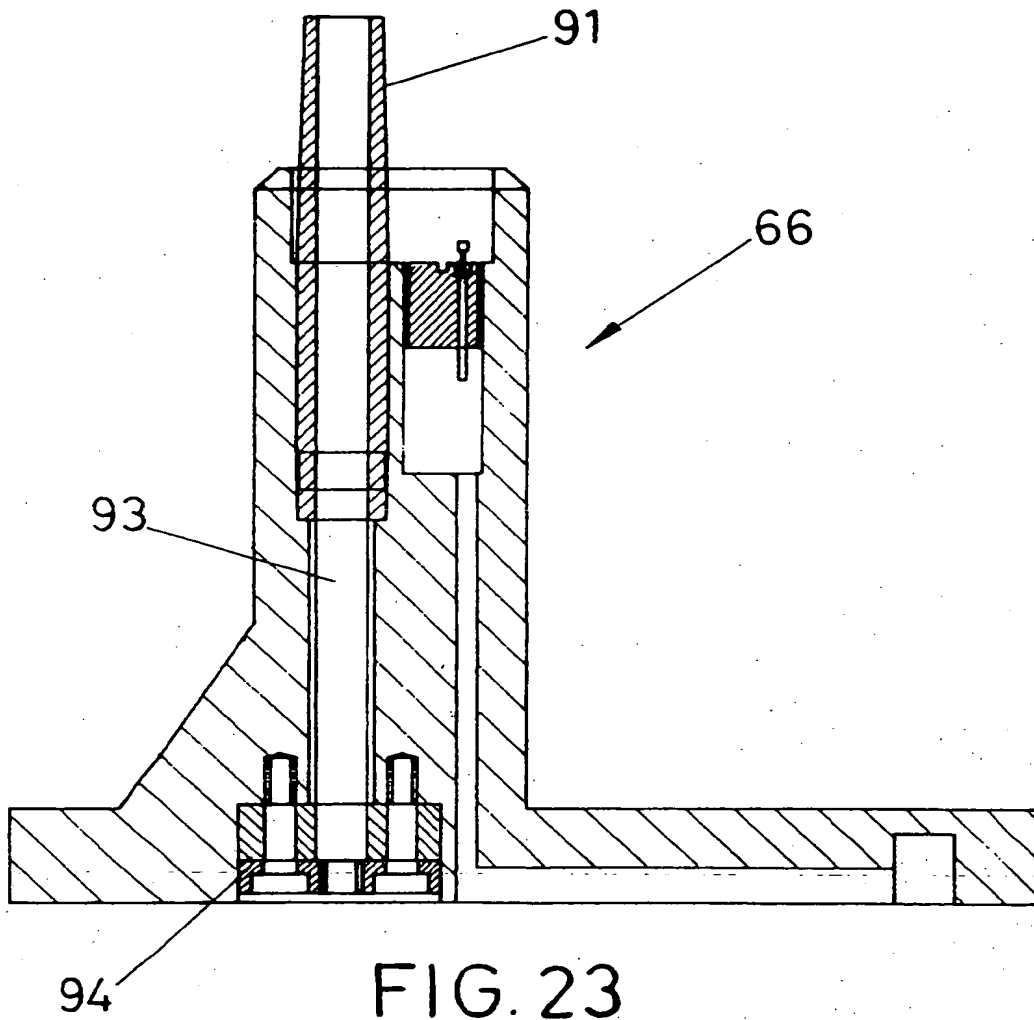


FIG. 15

A - A







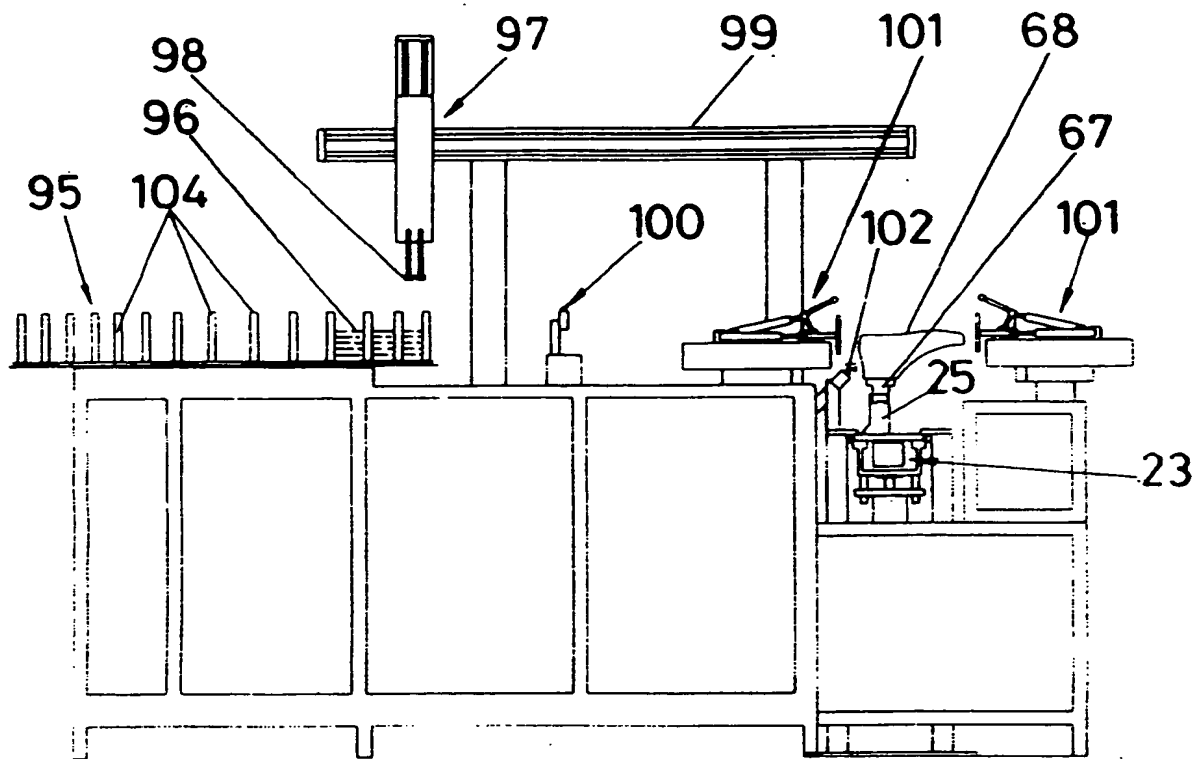


FIG. 24

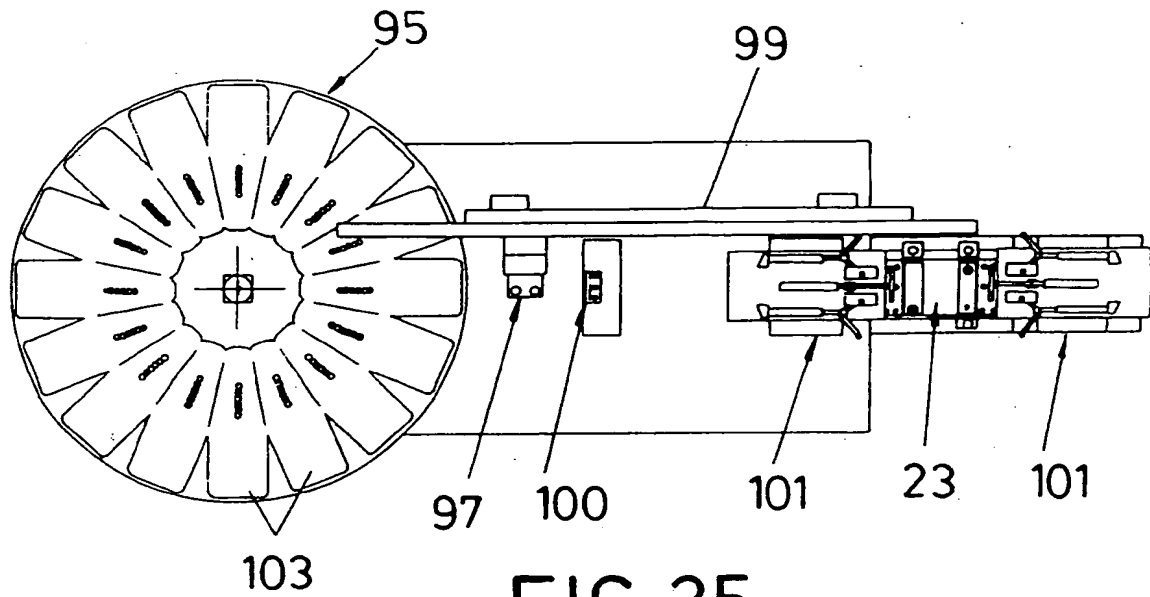


FIG. 25

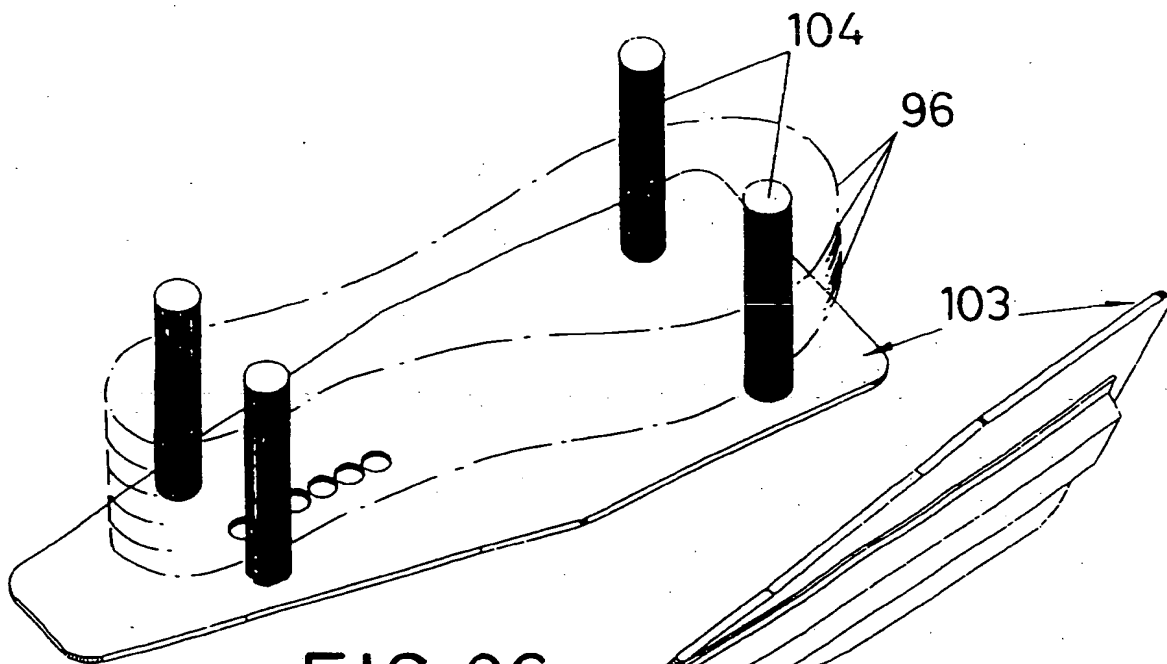
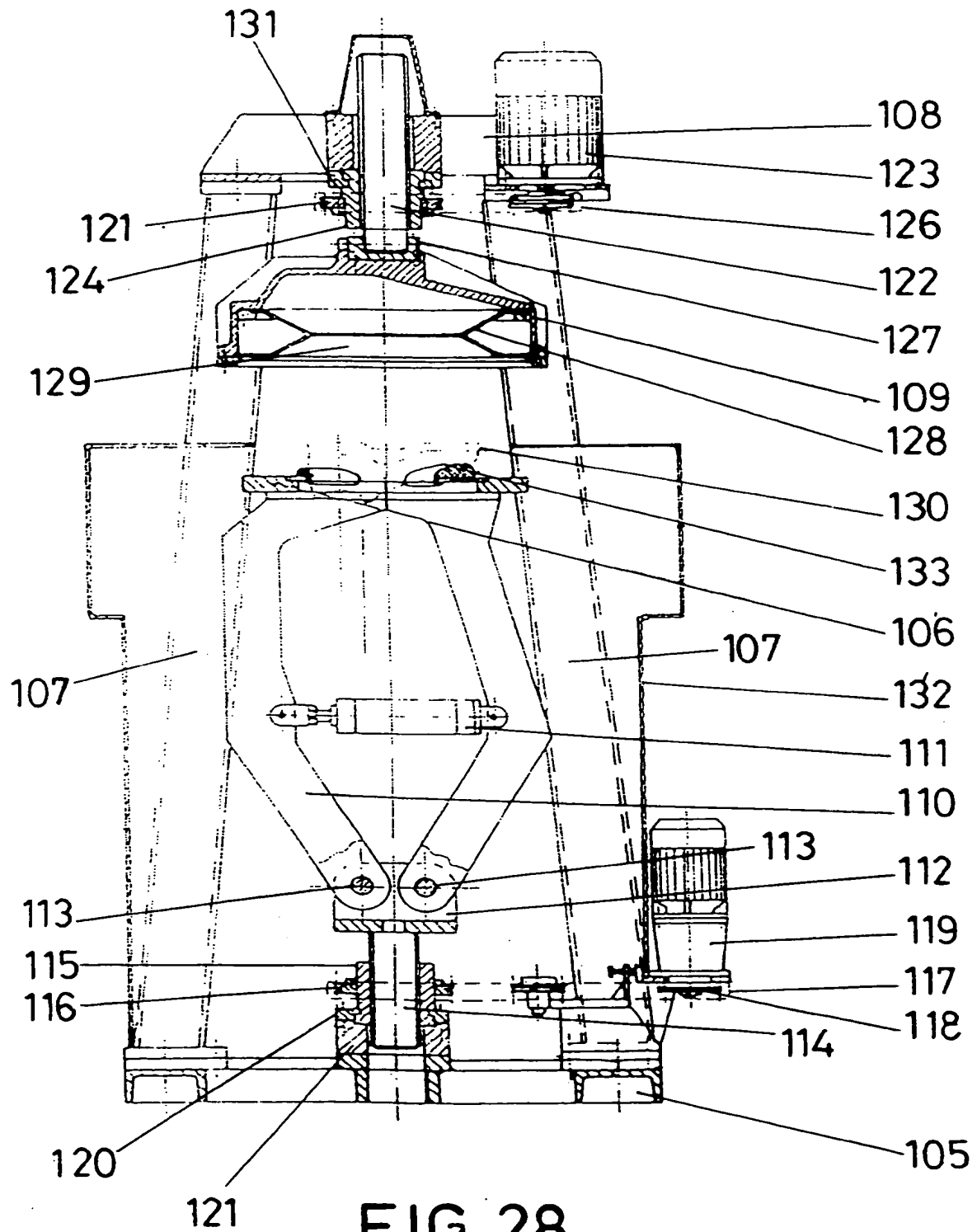


FIG. 26

FIG. 27



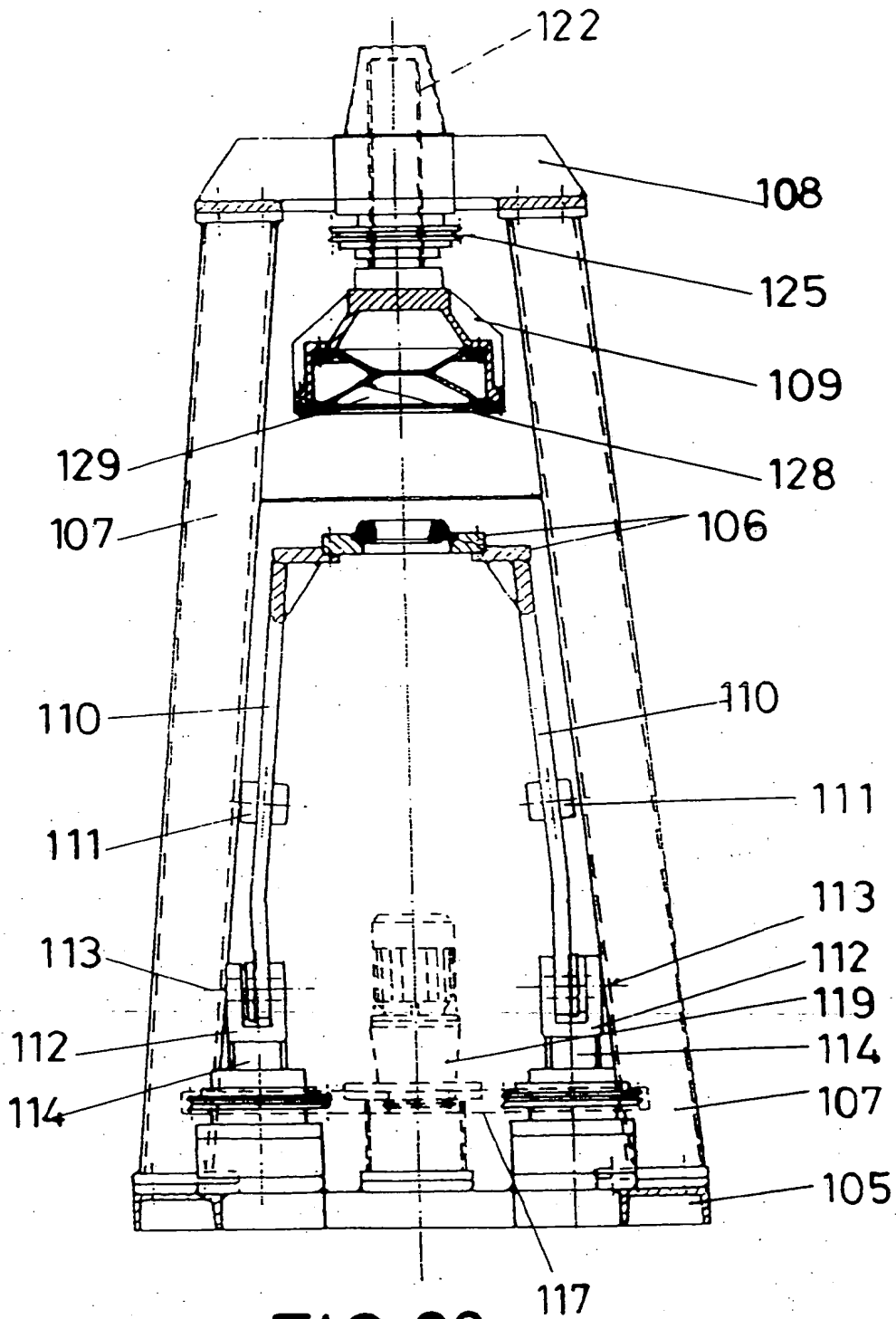


FIG 29

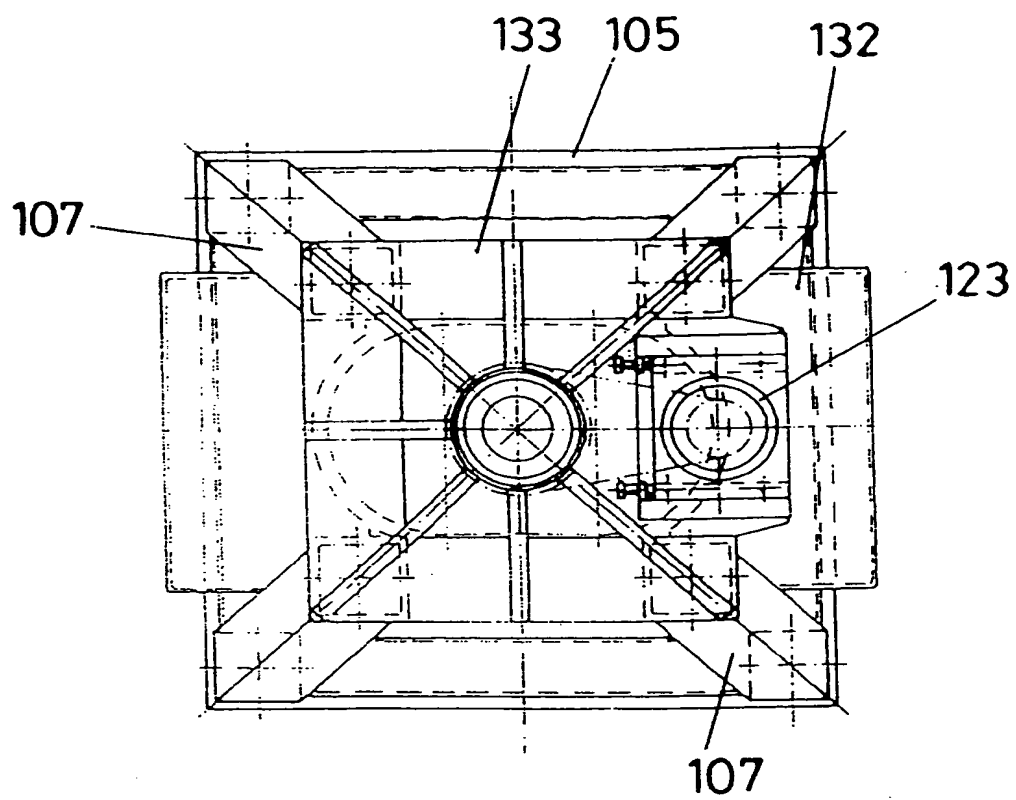


FIG. 30

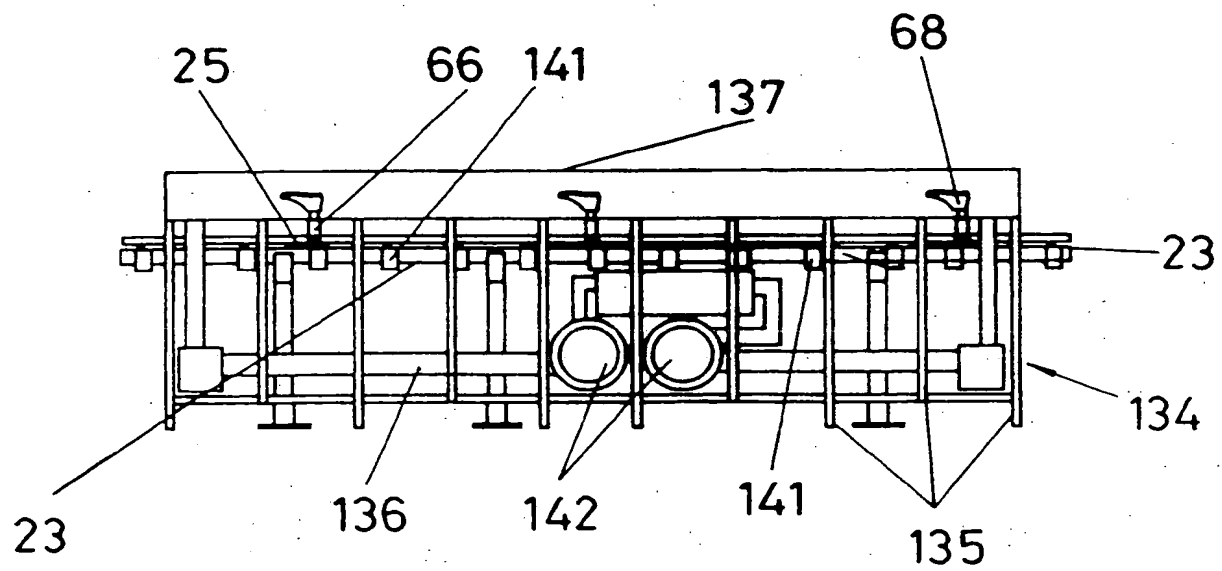


FIG. 31

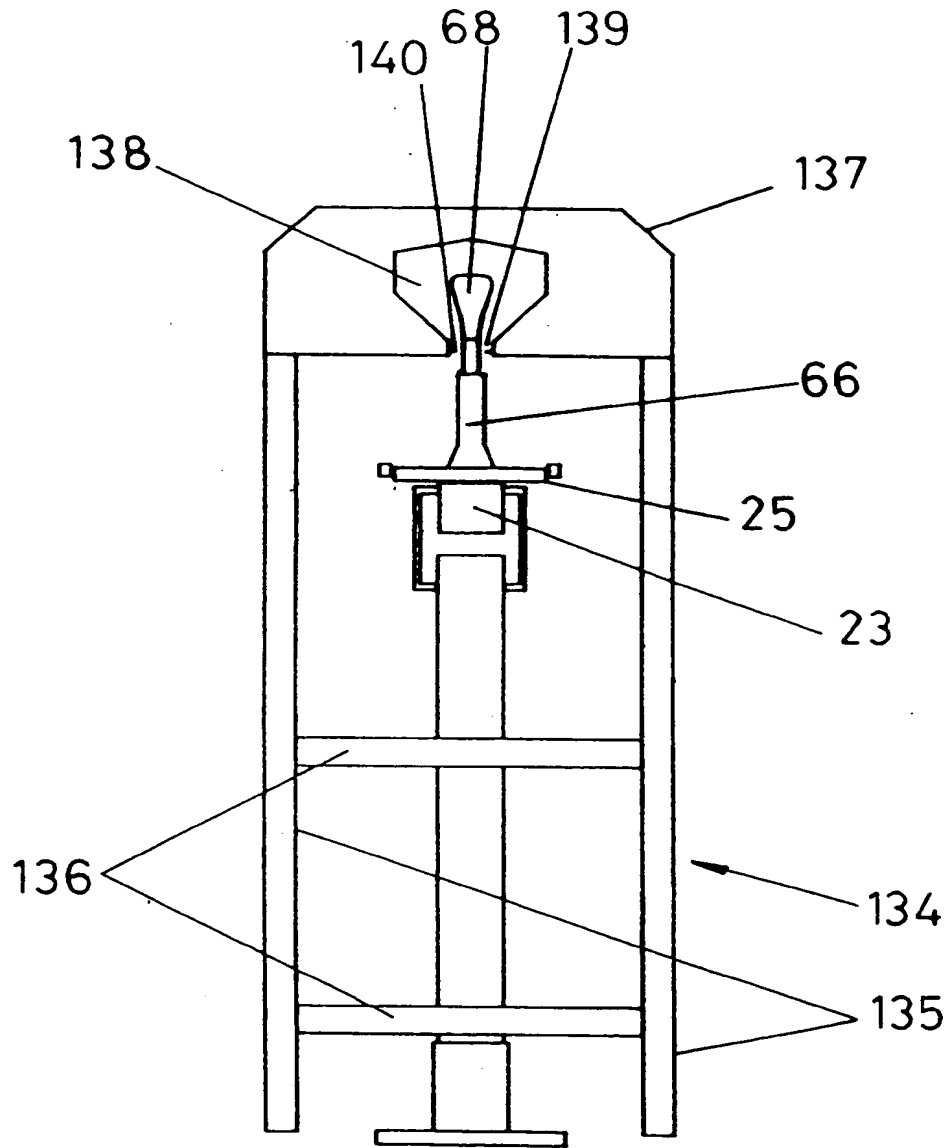


FIG. 32

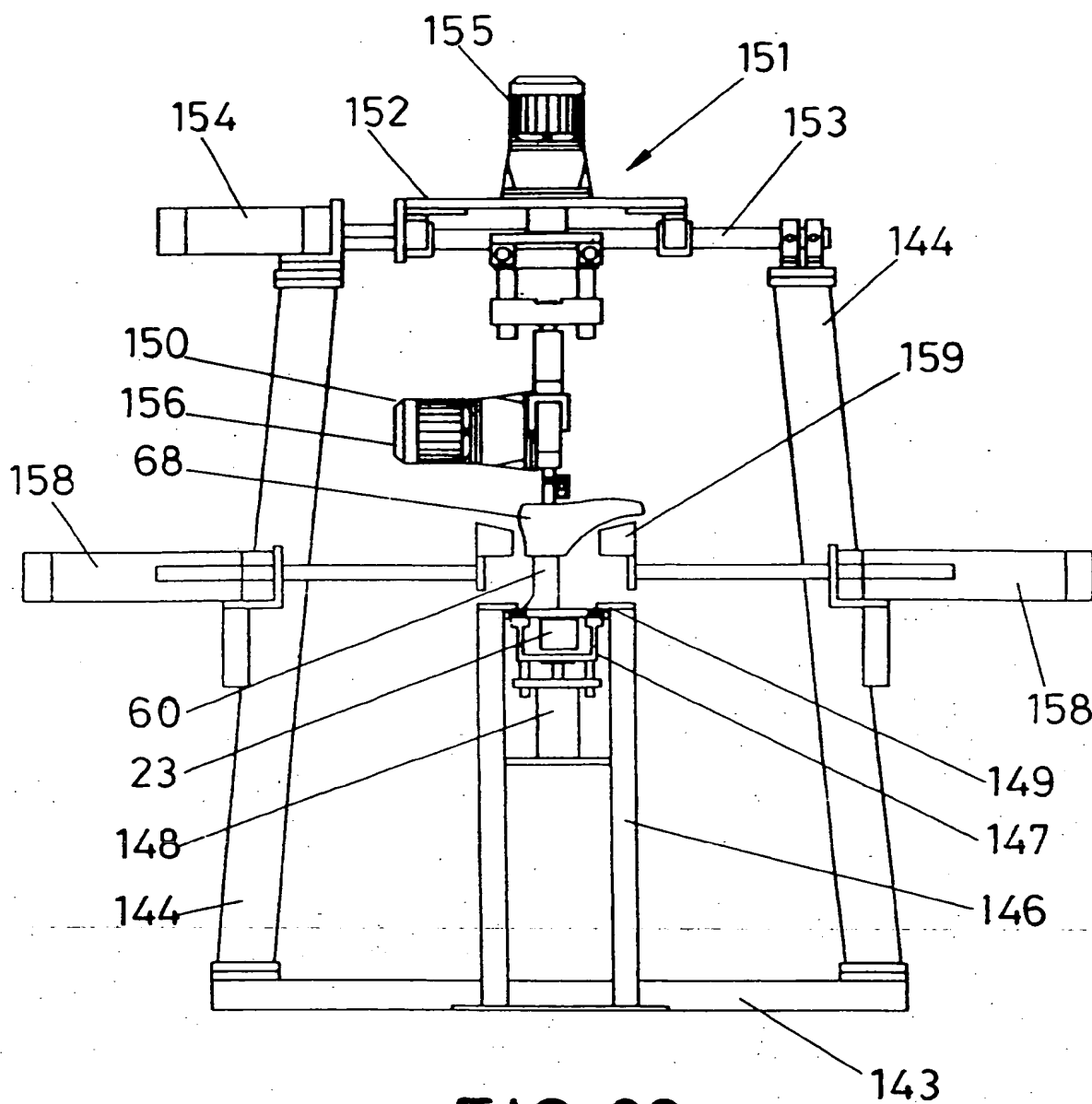


FIG. 33

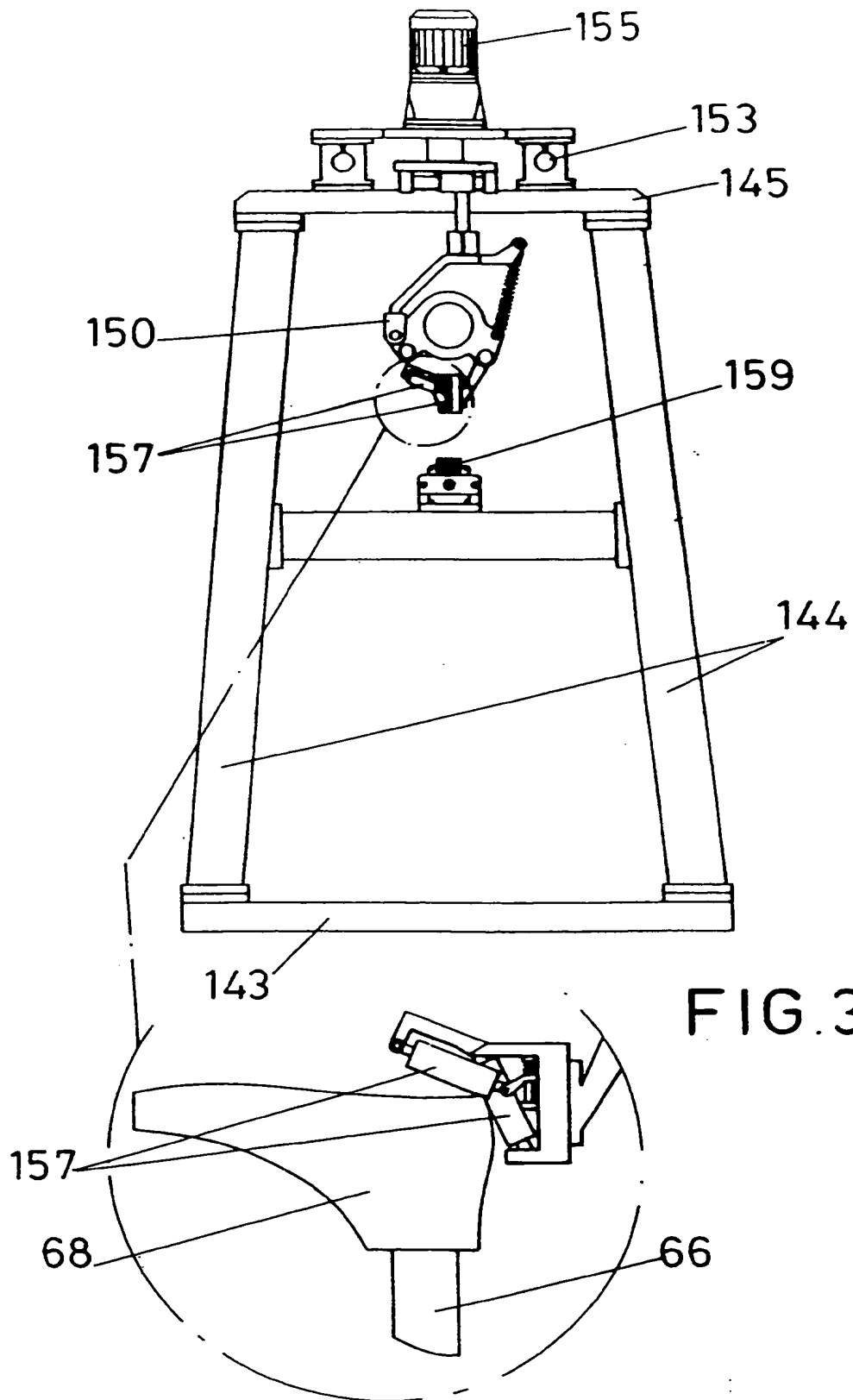


FIG. 34

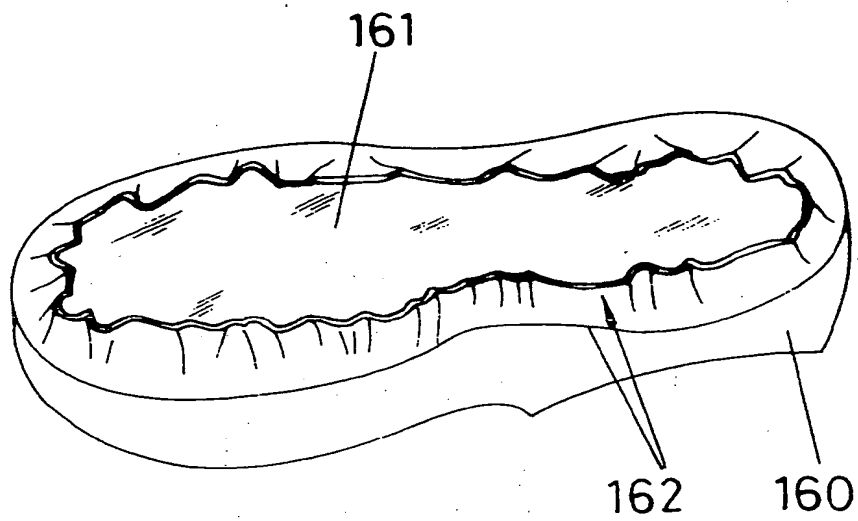


FIG. 35

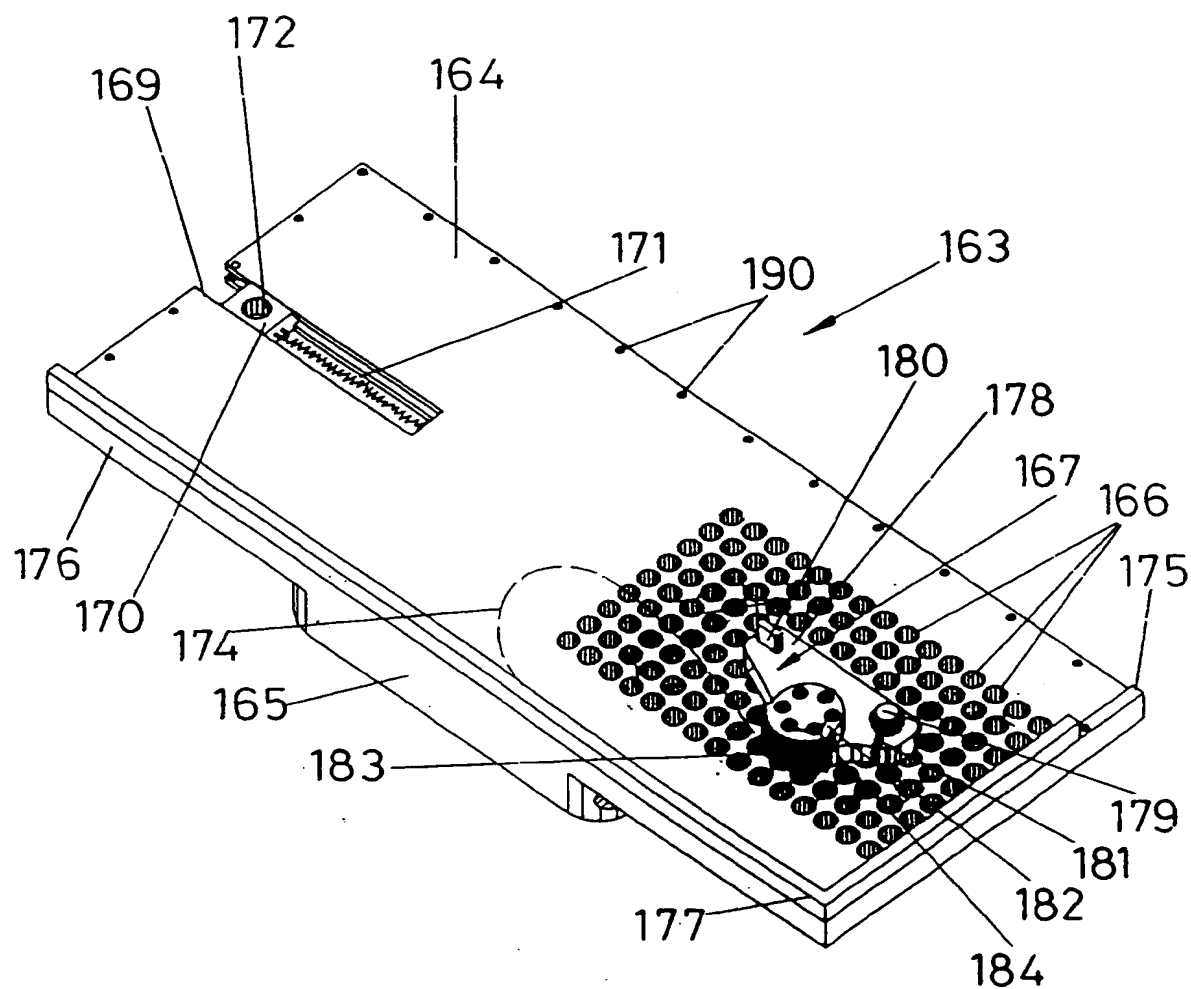


FIG. 36

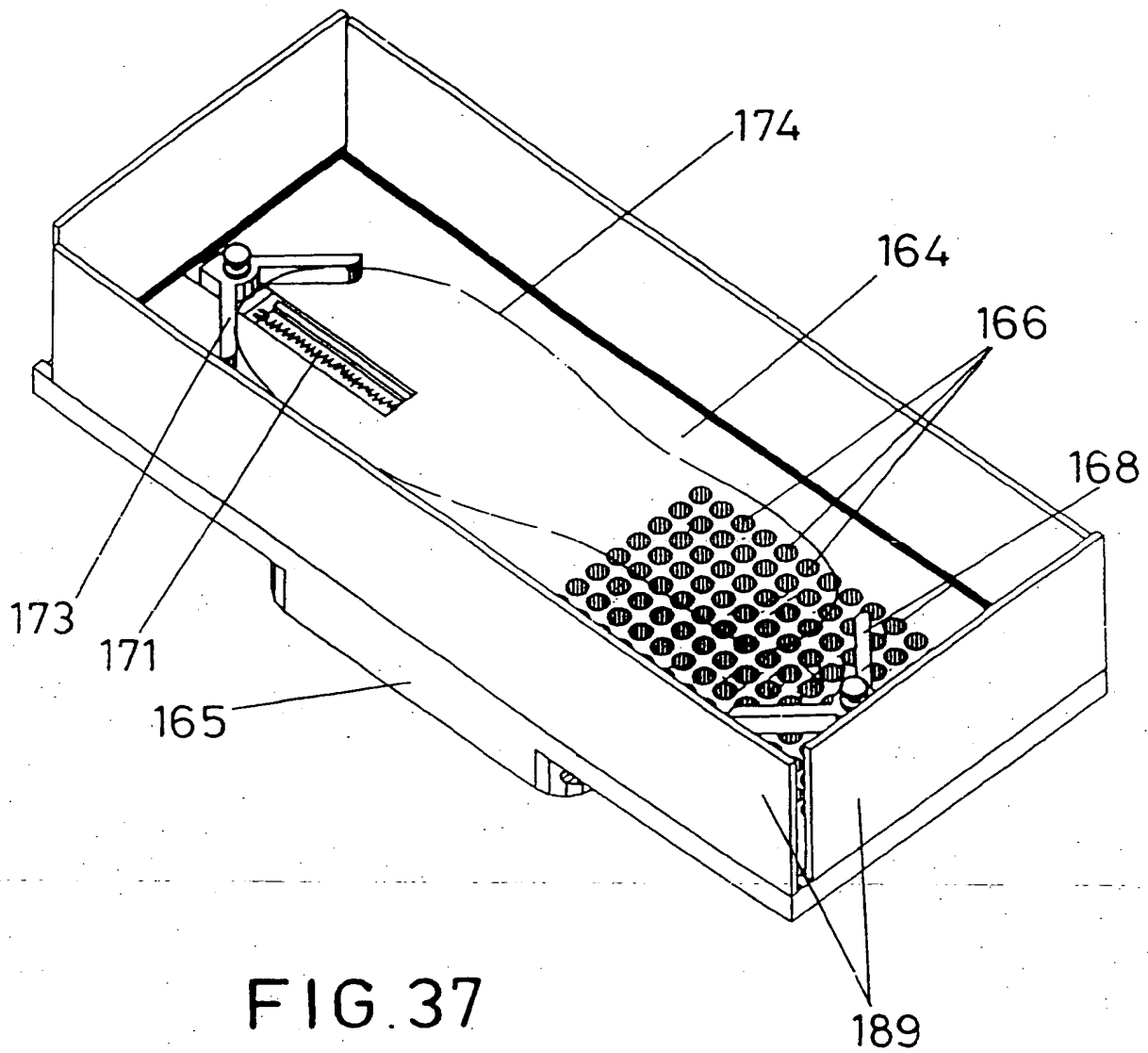
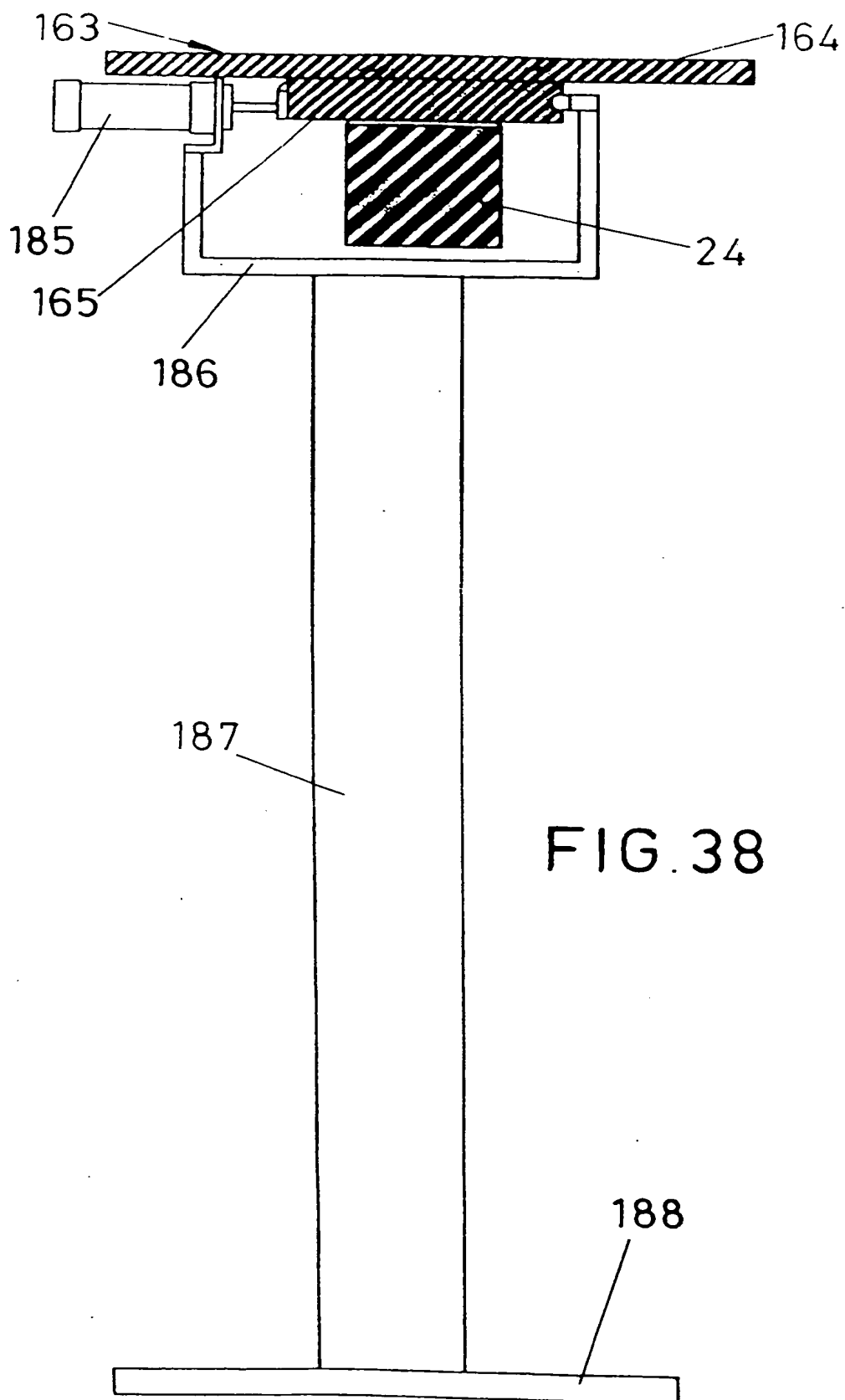
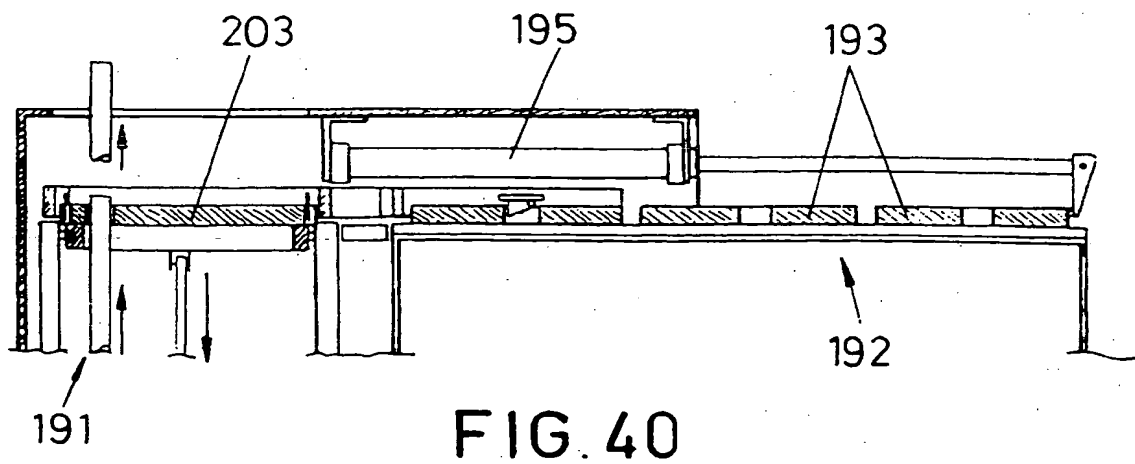
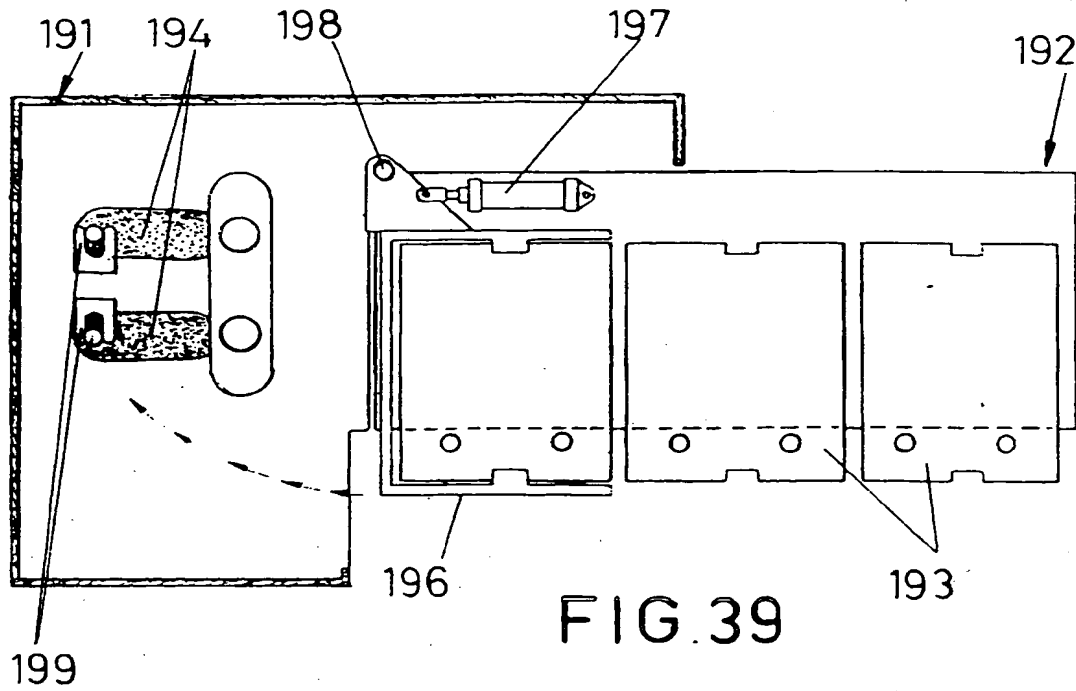


FIG. 37





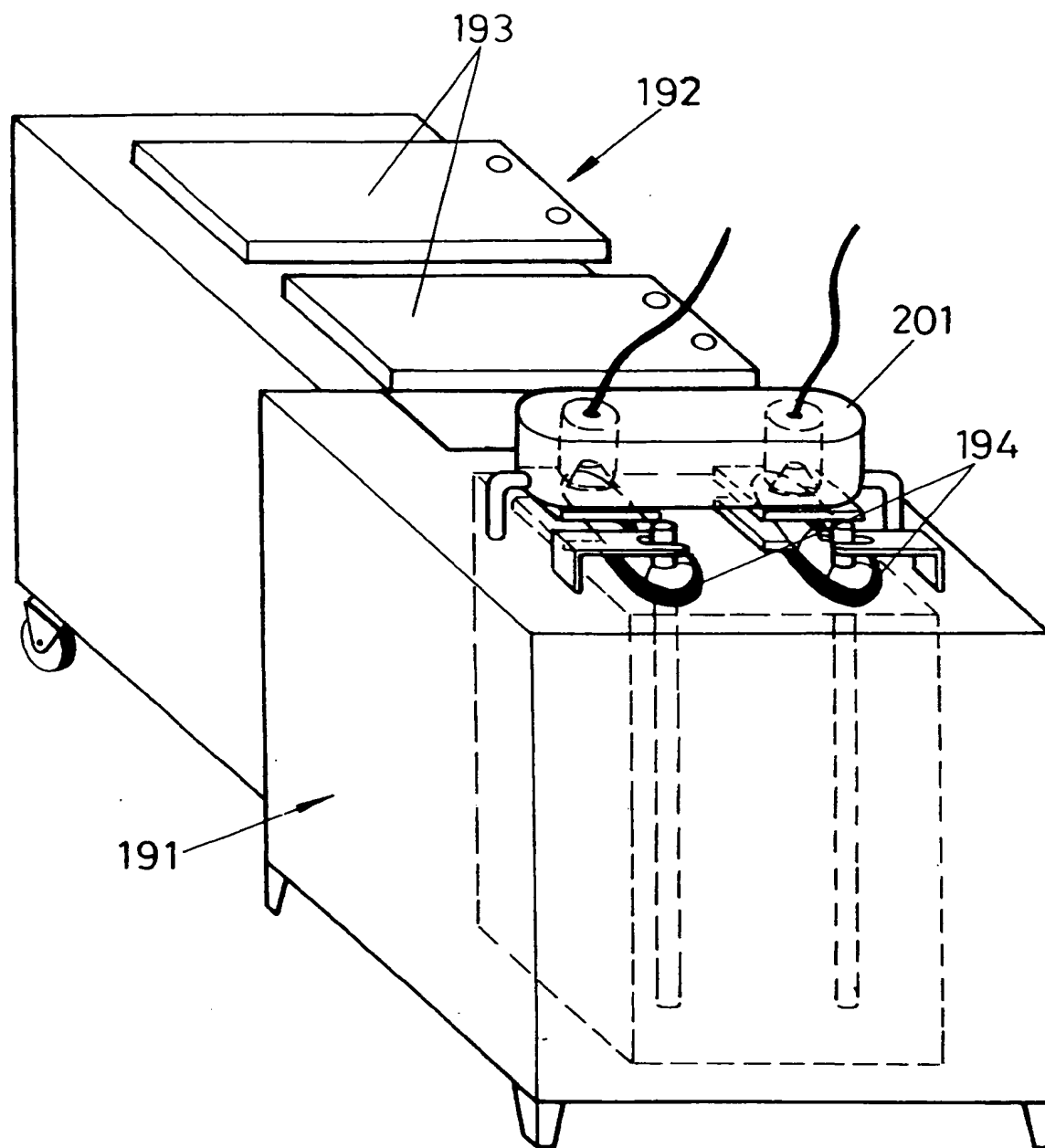
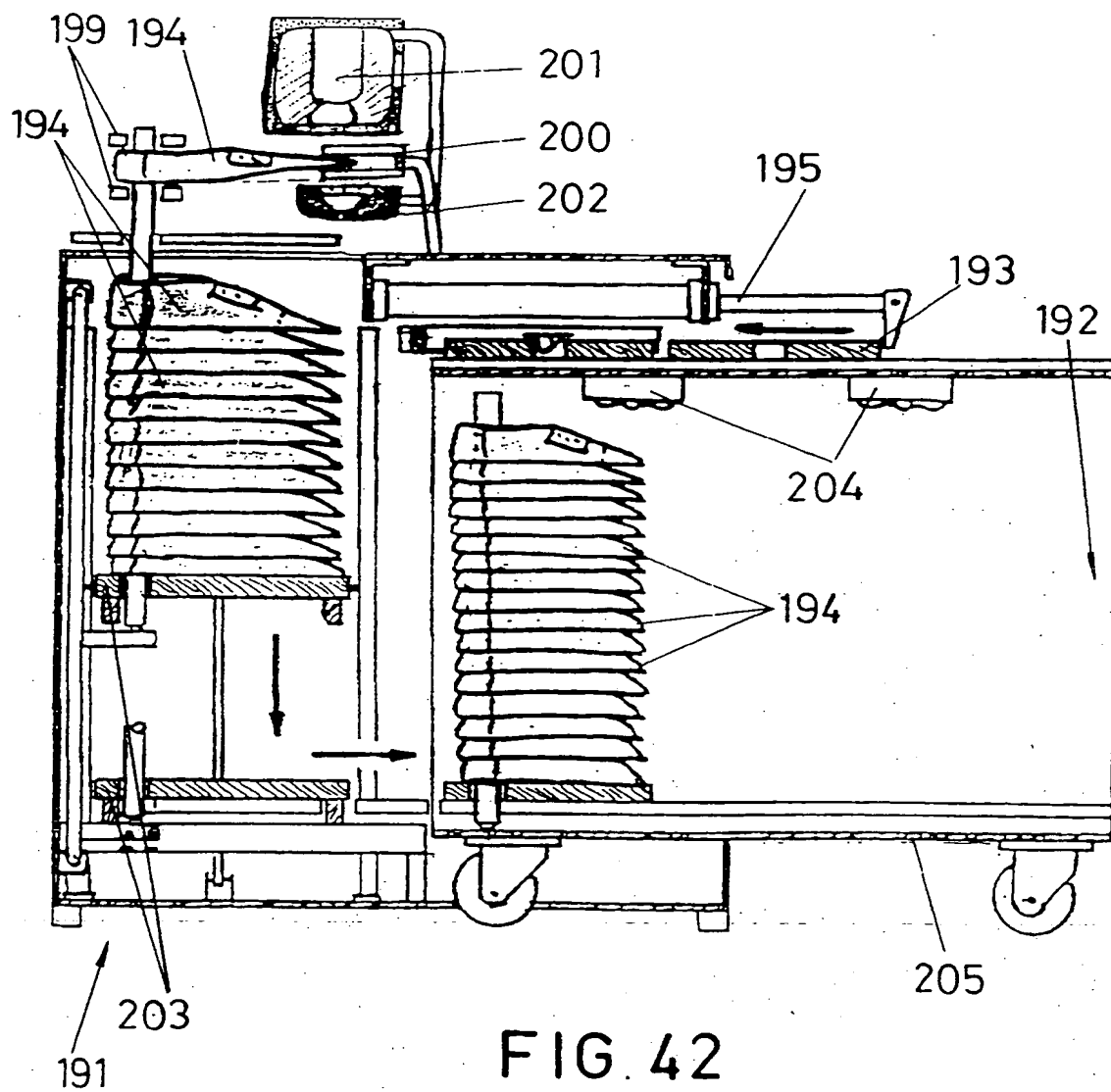


FIG. 41



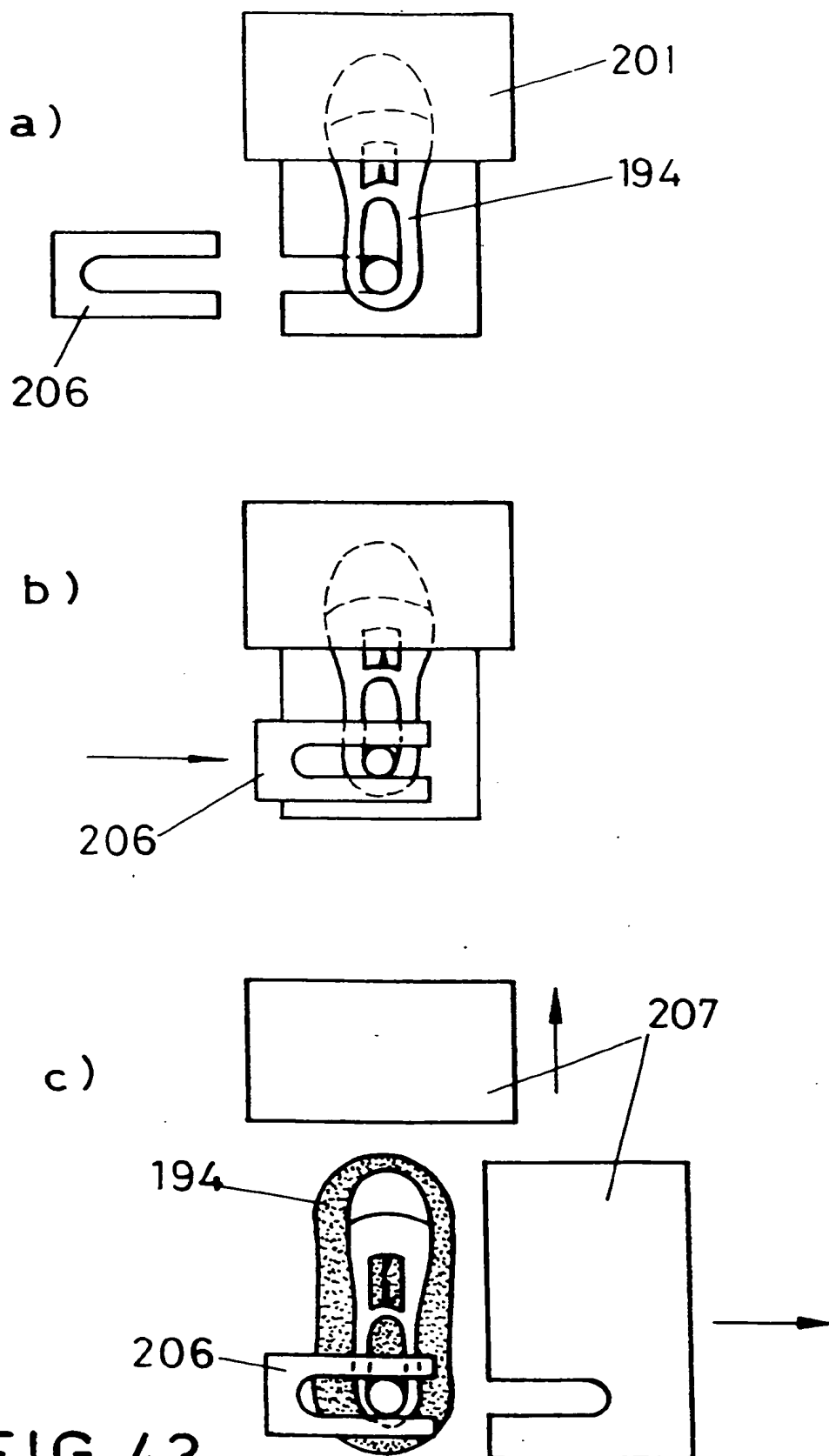
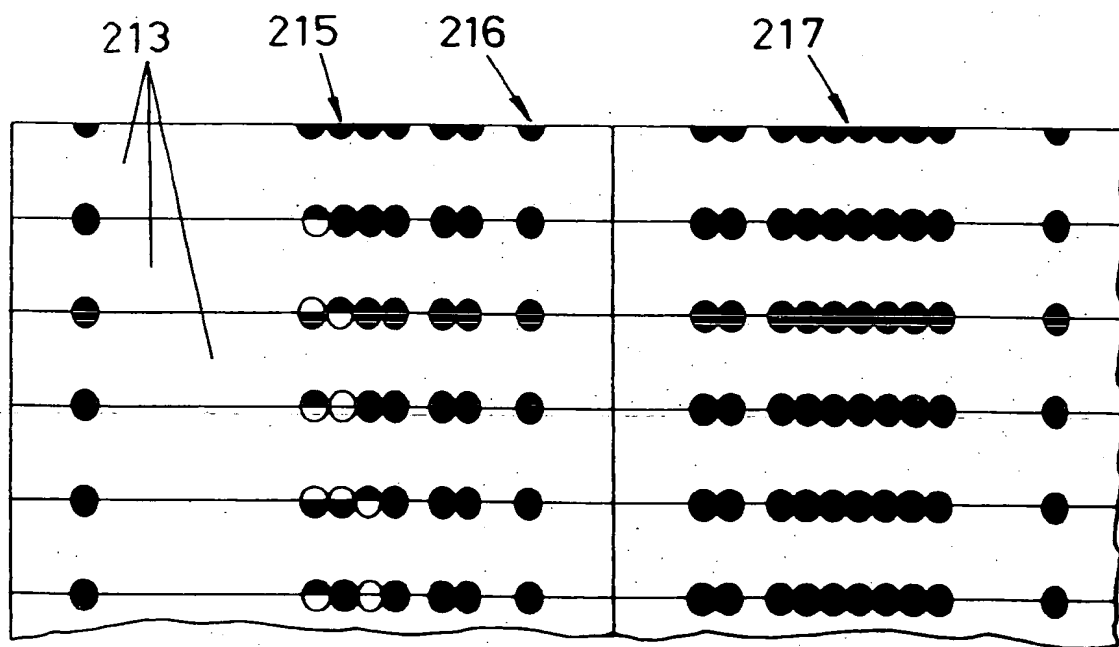
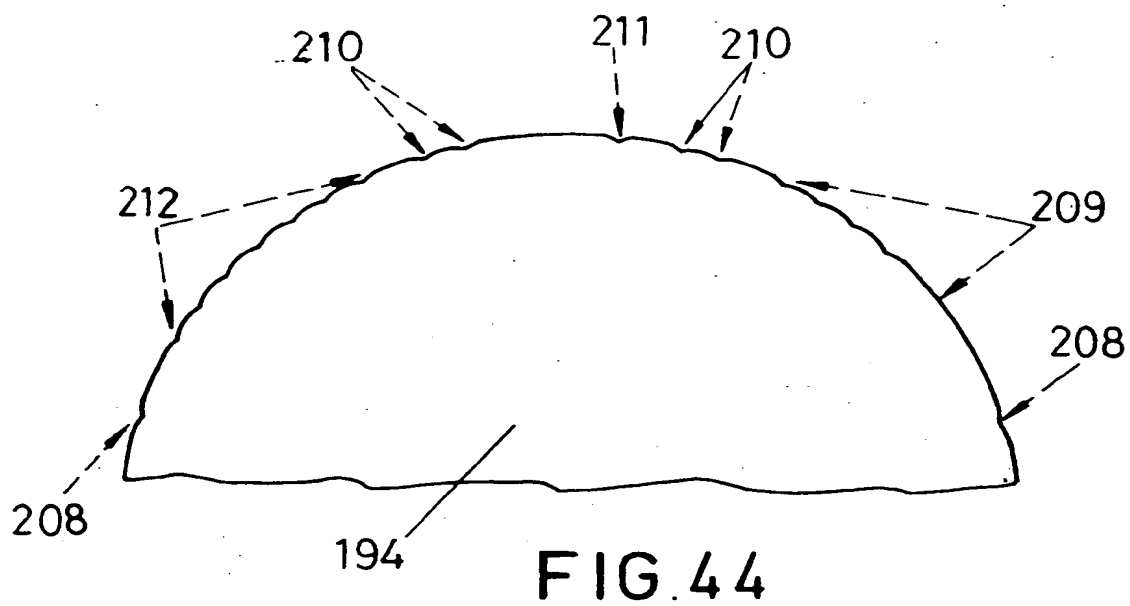


FIG. 43



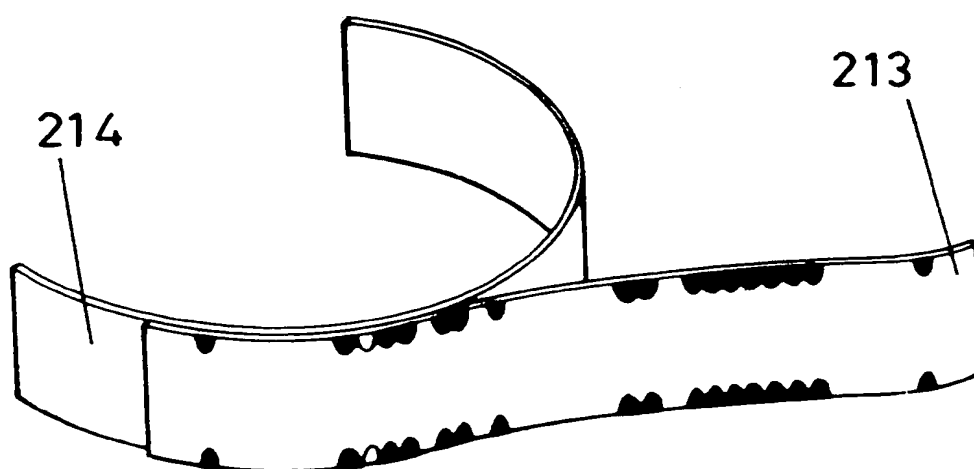


FIG. 46

## INTERNATIONAL SEARCH REPORT

International Application No  
PCT/ES 95/00012A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 A43D119/00 A43D111/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A43D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP,A,0 512 526 (IRON FOX SRL) 11 November 1992 see the whole document ---	1,2,9
A	EP,A,0 009 422 (BONNET PIERRE ; VILLARET REMY (FR); IMBERT G ETS (FR)) 2 April 1980 see the whole document ---	1,2,9
A	GB,A,2 215 984 (SHOEMAKERS LTD) 4 October 1989 see claims ---	1,2,7
A	WO,A,92 18026 (BREME TECNICA ; MECCANICHE BANF S R L COSTRUZI (IT)) 29 October 1992 see page 11 - page 12; figures ---	7,8
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Date of the actual completion of the international search

11 May 1995

Date of mailing of the international search report

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Mathey, X

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## INTERNATIONAL SEARCH REPORT

International Application No  
PCT/ES 95/00012

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP,A,0 329 007 (PSB FOERDERANLAGEN) 23 August 1989 see claims; figures ----	1,2,4-6, 13
A	FR,A,2 309 172 (VIGES SPA) 26 November 1976 see claims; figures ----	14
A	EP,A,0 340 390 (SCHOEN & CIE GMBH) 8 November 1989 see claims; figures -----	1-17

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